INSTRUCTION MANUAL

MODEL R2302
SPECIAL PURPOSE RECEIVER

K4OG/WB4RHH
CHES WATKINS
P. O. BOX 3268
FT. PIERCE, FLA. 33450

Defense Electronics
DIVISION OF DEI INDUSTRIES
producers of DEI and NEMS-CLARKE equipment

NEMS CLARKE
EQUIPMENT

For manuals contact Mr. Brown

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Rockville, Maryland 20854

ADDENDUM

The Model R2302 Special Purpose Receiver is a modified version of the Model R2301 Special Purpose Receiver described in the attached manual. The modification consists of the re-designing of the second limiter and extension of the tuning range.

The attached manual should reflect the following changes when used with the R2302 receiver.

Performance Specifications

Tuning Range . . . . . 215-400 mc.

Tube Complement

Symbol	Type	Function
V-204	6BA6W	Buffer-Amplifier
V-205	6U8	Oscillator-Mixer

Section II, Theory of Operation

Delete the discussion on pages 3 and 4 concerning the Second Mixer and Second Local Oscillator and substitute the following:

Buffer-Amplifier. A 6BA6W, V-204, is used to isolate the two oscillator stages and to provide amplification of the 60-mc signal from the first mixer; this buffer-amplifier stage has a bandwidth of approximately 2.5 mc. The signal from the first mixer is capacitively coupled to the input grid of V-204, a semi-remote cut-off 6BA6W. The tube is operated with AGC voltage on the input grid in order to increase the dynamic range of the receiver. The output is taken from the buffer-amplifier through a slug-tuned transformer, T-203, which is resonated at 60 mc, and feeds the grid of the second mixer.

Second Oscillator-Mixer. A type 6U8 tube, V-205, is used as an oscillator and mixer. The triode section of the tube is utilized in a modified Colpitts configuration and is conventional. The oscillator frequency, 81.4 mc, is set by adjusting the slug of L-219. The output from the oscillator is taken from the plate circuit and capacitively coupled to the input grid of the pentode section of the same tube which functions as the second mixer. The outputs from the oscillator and buffer-amplifier are mixed in the pentode section and the output, including the 21.4 mc component, is then fed through jack J-204 to the IF amplifier.

Section IV, Maintenance

Under Local Oscillator Adjustment on page 16, change 562 mc to read 462 mc; change 307 mc to read 274 mc. Under RF Alignment on page 18 change 502 mc to read 402 mc; change 247 mc to read 214 mc.

Delete the material under Mechanical Adjustments on page 16 and substitute the following:

Mechanical Adjustments. CAUTION: Normally no adjustments are necessary to the gear train. However, if the above local oscillator adjustments do not produce the proper tracking of the tuning dial, refer to the following procedure:

1. Loosen both gear train stops.
2. Rotate dial to extreme high-frequency end until dial is stopped by inductuner stop. Hairline should align with extreme hairline on dial. (If not, loosen set screws on inductuner shaft and align hairlines. Retighten screws.)
3. Back up just off inductuner stop until hairline aligns with triangle on dial and tighten set screws in dial drive high-frequency stop.
4. Rotate dial to extreme low-frequency end until hairline aligns with triangle on dial.
5. Tighten set screws in dial-drive low-frequency mechanical stop.

Delete the material under Alignment of Second Converter on page 19 and substitute the following:

Alignment of Second Converter. The curve obtained by the following procedure should be a double-tuned symmetrical response centered around 60 mc and nearly flat-topped. The bandwidth at the half-power points should be approximately 2.5 mc. In carrying out the alignment, do not disturb in any manner the lead dress and mechanical layout of the components in the RF chassis.

1. Set function switch to AM and AGC switch to MAN.
2. Connect oscilloscope to TP-202.
3. Remove bottom cover from converter subassembly.
4. Feed 60 mc sweep signal to pin 1 of V-204, grounding cable nearby.
5. Detune L-216 by turning tuning slug all way in.
6. Set oscilloscope sensitivity and sweep output to produce deflection.
7. Adjust both primary and secondary of T-203 to give double-tuned symmetrical response centered around 60 mc.
8. Replace bottom cover, ensuring that screws are secure.
9. Feed 60 mc sweep signal to TP-201 on RF chassis, grounding cable nearby.

10. Adjust both L-216 and T-201 for a double-tuned symmetrical response centered around 60 mc with oscilloscope sensitivity set as before and sweep output adjusted to produce 0.25 volt p-p deflection.

11. If sweep output is not great enough to produce a peak oscilloscope deflection of 0.25 volt, connect directly to grid of mixer, pin 1 of V-202.

12. This completes the alignment procedure.

Tube Voltage Chart

Tube	Type	1	2	3	4	5	6	7	8	9
V-201	5842/417A	114	Gnd	Gnd	Gnd	Gnd	1.0	Gnd	Gnd	6.3 VAC
V-204	6BA6W	-2.4	Gnd	Gnd	6.3 AC	142	110	0.8	--	---
V-205	6U8	72	-2.5	50	6.3 AC	Gnd	145	Gnd	Gnd	Do Not Meas.

Schematic Diagram

RF Amplifier/First Mixer/First Local Oscillator

The extension of the tuning range required component changes in the input circuitry. The schematic diagrams should reflect the following changes.

R202 is changed from a 150Ω unit to a 1.8k, 2W, unit; and disconnected from between the plate of V-201 and R-203/L-203, and reconnected between R-203/L-203 and C-223 feed-thru capacitor. A direct connection is made between the plate of V-201 and R-203/L-203.

C-207 is removed and a coil, L-212, is connected in its place.

A coil, L-214, has been connected between the junction of C-213/C-214 and the tank circuit of L-206/L-201D.

Second Limiter

A schematic diagram of the modified second limiter is shown in figure 1.

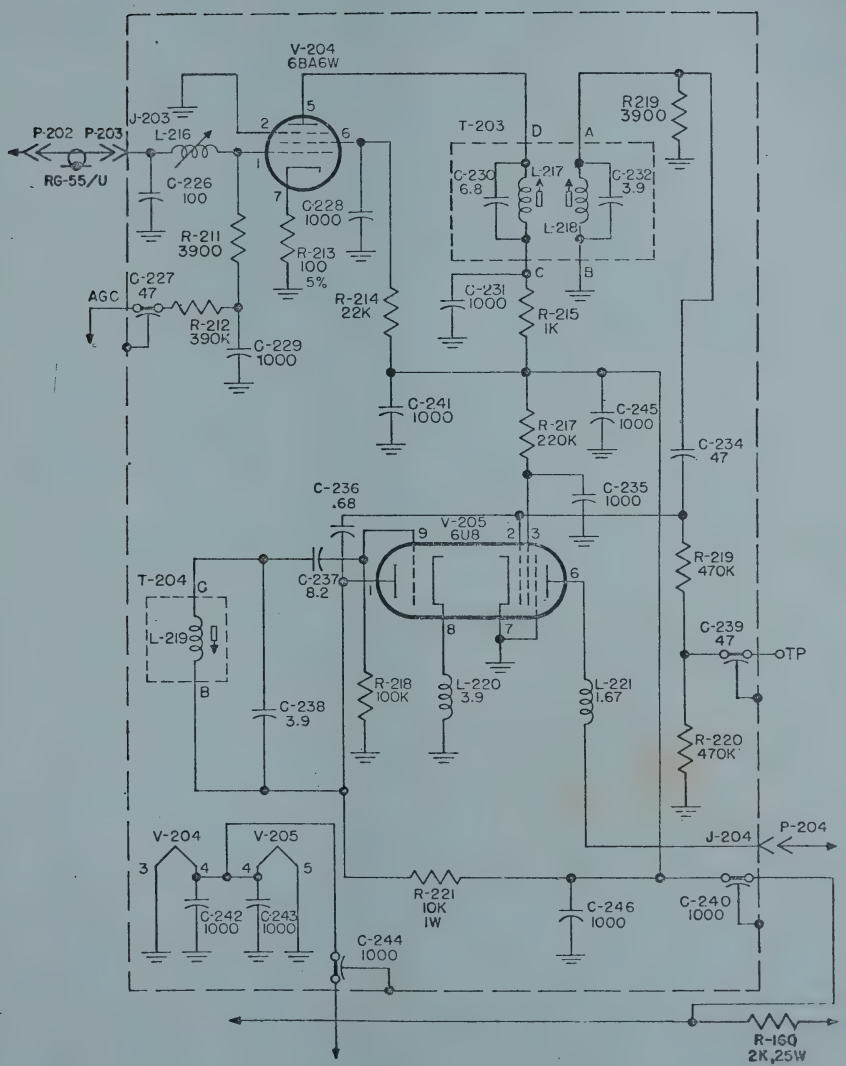

Figure 1. Second Limiter, R2302, Schematic Diagram

NEMS CLARKE
EQUIPMENT

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MODEL 2301
SPECIAL PURPOSE RECEIVER

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Defense Electronics
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DEI
INDUSTRIES

Rockville, Maryland 20854

EFFECTIVE PAGES

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WARNING

This equipment employs voltages which are dangerous and may prove fatal if contacted by operating personnel. Extreme caution should be exercised while operating this equipment.

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Figure 1-1. Special Purpose Receiver 2301

SECTION I
GENERAL DESCRIPTION

1.1 PURPOSE OF EQUIPMENT

The Model 2301 Receiver has been specifically designed with a high degree of stability to operate in the 250-500 MHz range and is a very sensitive AM-FM-CW receiver for critical application in this range.

The receiver has self-contained power supplies and is capable of operation from a power source of 115/240 volts ±10%, 50 to 60 and 400 Hz ±5%, single phase, alternating current. Selection of primary voltage is accomplished by a two-position toggle switch located on the rear apron of the chassis. The switch is equipped with a locking device which prevents accidental switching from one voltage to the other.

Among the special features of the Model 2301 Receiver are audio squelch with adjustable threshold, FM reception with very low distortion, AM reception, BFO for CW reception, and a separate high-quality 600 ohm audio output. The video output signal passes through a variable low pass filter, allowing a greatly improved S/N ratio when the full video bandwidth is not needed.

1.2 DESCRIPTION OF EQUIPMENT

The Model 2301 Receiver is 8-23/32 inches high, 14-1/4 inches deep, and 19 inches wide. Weight is approximately 32 lbs. Panel and chassis are of aluminum construction, and the panel is finished in smooth gray-blue enamel. The unit is designed for standard 19-inch relay rack mounting, although the receivers are equipped with dust covers and louvered side panels, and may be used independently on a shelf or table. The IF amplifier and RF tuner are built as completely shielded subassemblies.

Table 1-1. Specifications

Tuning Range	250-500 MHz.
Noise Figure	14 dB maximum; 10-12 dB average.
IF Rejection	60 dB minimum.
Image Rejection	50 dB minimum.
Sensitivity	8 μV produces at least 23 dB S/N ratio with 100 kHz deviation, 1000 Hz modulation frequency.

continued

Table 1-1, continued

1st IF	60 MHz.
2nd IF	21.4 MHz.
IF Bandwidth	300 kHz.
Input Impedance	50 ohms, nominal.
Video Response	10 Hz to 300 kHz.
Video Bandwidth Control	5 positions - 1, 2, 10, 30, and 300 kHz.
FM Output	0-10 volt RMS per kHz deviation, approximately.
AM Output	10 volts RMS for 5 μV input modulated 30% at 400 Hz.
FM Output Stability	varies less than 2 dB for inputs above 4 μV.
AM Output Stability	7 dB maximum variation in 40 dB variation in input.
Outputs Provided	1. Spectrum Display Unit jack 2. High impedance video 3. 600 ohms Audio 4. Panel mounted speaker 5. Panel mounted phone jack 6. Frequency Monitor Output jack.
Power Requirements	115/230V; 50-60 and 400 Hz; approximately 75 watts.
Weight	32 lbs.

Table 1-2. Tube Complement

Symbol	Type	Function
V111	6CB6	BFO
V114	OA2	Voltage Regulator
V115	12AU7	Squelch
V116	12AU7	Audio Amplifier
V117	12AU7	1st Video Amplifier and Tuning Meter Bridge
V118	12AU7	Video Output
V201	5842/ 417A	Grounded Grid RF Amplifier
V202	6AK5	1st Mixer
V203	6AF4A	1st Local Oscillator
V204	6AK5	2nd Mixer
V205	6BQ7A	2nd Local Oscillator
V301	6DC6	1st IF Amplifier
V302	6DC6	2nd IF Amplifier
V303	6CB6	3rd IF Amplifier 1st Limiter
V304	6AK5	AM Detector FM, 2nd Limiter
V305	6AL5	Discriminator

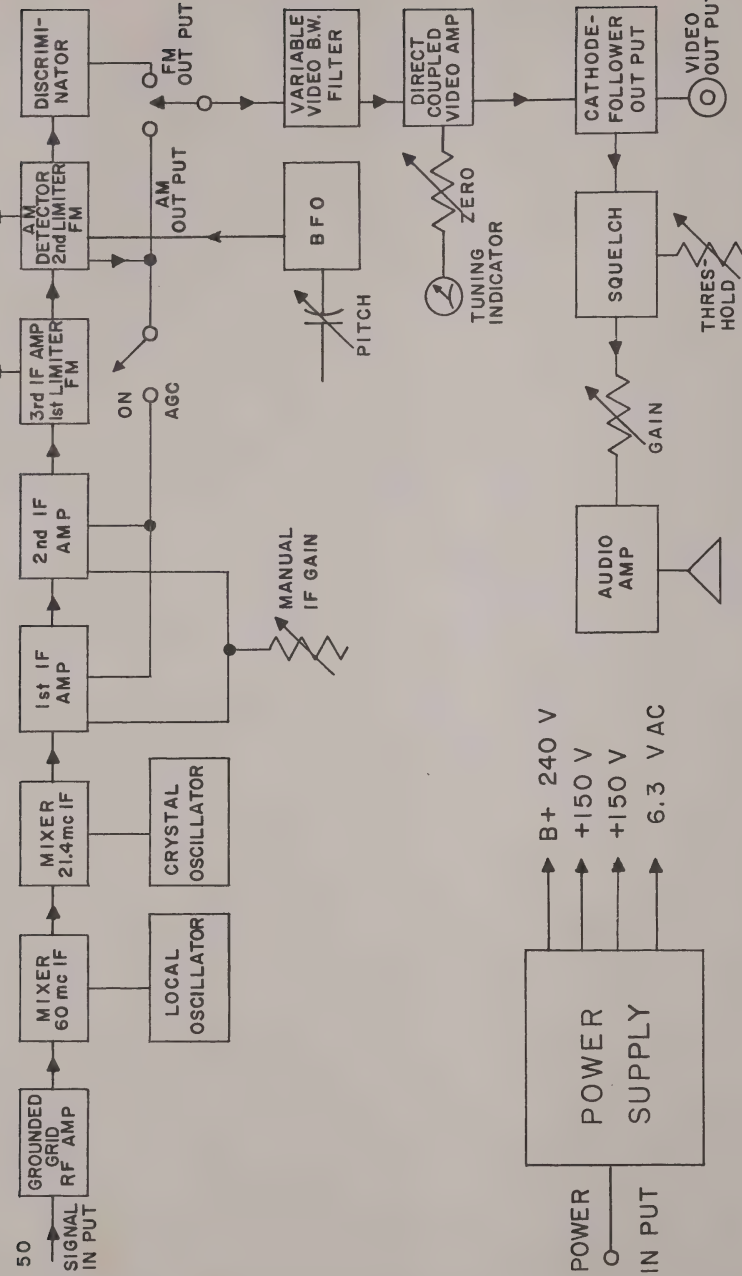


Figure 1-2. Block Diagram, 2301 Receiver

SECTION II
PRINCIPLES OF OPERATION

Model 2301 is a 16 tube AM-FM-CW superheterodyne receiver incorporating double conversion with a first IF of 60 MHz, and a second IF of 21.4 MHz. Tuning is over the frequency range of 250-500 MHz. The tuner, a Mallory four section UHF inductuner, has been modified to produce continuous tuning with the lowest possible noise figure and uniform response over the tuning range of the receiver.

The i-f amplifier, with the FM-AM switch in the FM position, uses two stages of amplification, cascade limiters, and a phase-shift discriminator. With the FM-AM switch in the AM position, AGC voltage is applied to the first two stages, and the second limiter becomes the AM detector.

The output signal of the i-f strip, (AM or PM) is fed through a variable lowpass filter, thus providing the maximum S/N ratio when the full video bandwidth is not needed. The output of the filter drives a two-stage direct-coupled video amplifier with a cathode follower output. A portion of the cathode follower output drives a four-stage squelch audio amplifier circuit.

2.1 ANTENNA

The input impedance of the receiver is approximately 50 ohms over the frequency range of 250-500 MHz. The input signal is applied through a type "N" coaxial receptacle (UG-1052/U) located on the rear apron of the chassis.

2.2 RF AMPLIFIER

From the antenna input jack, J201, the signal is applied to the cathode of the grounded grid rf amplifier, V201, 5842/417A. The basic tuning element for the cathode of V201 is one of four sections in the Mallory UHF Inductuner, L210A, which broadly resonates the cathode circuit to the frequency of the desired input signal. Cathode resistor, R201, provides self bias for V201 and the capacitor, C203, provides cathode by-passing. A double tuned bandpass circuit couples the plate of V201 to the grid of the mixer, V202. The coupling is capacitive and the basic tuning elements are two sections of the Mallory UHF Inductuner, L210B and L210C. The addition of shunt coils external to the inductuner increases the high end tuning range.

2.3 FIRST MIXER

A 6AK5 pentode, V202, is used as the first mixer which receives the first local oscillator injection voltage through the coupling capacitor, C217. An operational

grid bias voltage is developed across resistors R204 and R205 proportional to the amplitude of the oscillations. This causes a minimum effect on the receiver operation due to variations in local oscillator amplitude. A test point, (TP201) located between R204 and R205 provides a convenient means for measuring oscillator injection voltage. The output plate circuit is tuned for maximum output at 60 MHz.

2.4 FIRST LOCAL OSCILLATOR

The first local oscillator utilizes a 6AF4A tube, V203, in a modified Colpitts circuit. Tuning is accomplished by one section of the Mallory UHF Inductuner, L210D, and excellent tracking is realized over the entire tuning range. The frequency stability of the oscillator is very high due to the use of a high transconductance tube and by keeping the changes in frequency, due to the variations in oscillator amplitude, at a minimum.

2.5 SECOND MIXER

A 6AK5 pentode, V204, is used as the second mixer. The second oscillator signal is inductively coupled into the grid of the second mixer by T202. The 60 MHz i-f from the first mixer passes through a lowpass filter and is then capacitively coupled along with the second oscillator signal to the grid of the second mixer. Test point 202 provides a convenient means for measuring oscillator injection voltage.

2.6 SECOND LOCAL OSCILLATOR

A Butler type crystal controlled oscillator is used as the second local oscillator. The circuit has excellent characteristics such as frequency stability, reliability, and simplicity. A 6BQ7A twin-triode, V205, with one section as a cathode follower and the other section as a grounded grid amplifier, is used in this circuit. The crystal is connected between the cathode of the two tube sections and provides output at 21.4 MHz.

2.7 IF AMPLIFIER

a. FM-AM switch in FM position. The first i-f transformer, located on the i-f subassembly, is connected to the second mixer plate through a short length of RG-62/U coaxial cable. Two high gain stages (V301, V302) using 6DC6 tubes are followed by a 6CB6 (V203) first limiter and a 6AK5 (V304) second limiter. A 6AL5 (V305) is used in a phase-shift discriminator circuit. Accurate balance is obtained by using a bifilar winding for the transformer secondary. An automatic gain control voltage is derived from

the first limiter (V303) grid circuit and applied to the first i-f amplifier. The first i-f amplifier and the first limiter do not have their cathode resistance bypassed, thus causing cathode degeneration which practically eliminates the detuning caused by changes in tube input capacitance resulting from a change in grid bias. A minimum of approximately one volt bias is found on the second limiter due to grid rectification of noise signals. A self-resonant choke (L315) is connected in the output lead of the discriminator to prevent i-f signals from leaving the i-f subassembly. A relative signal strength meter is operated from the voltage developed at the grids of the limiters.

b. FM-AM Switch in AM position. The paragraph above also applies when the receiver is operating with the FM-AM switch in the AM position, with the exceptions noted herein. The first two high-gain 6DC6 remote cutoff i-f amplifiers, V301 and V302, receive an agc voltage developed at the grid of the 6AK5 a-m detector, V304. The third i-f amplifier, V303, which drives the a-m detector, is not gain controlled, but its signal-handling capabilities have been improved by increasing the screen voltage. A self-resonant choke, L312, is connected in the a-m output lead from the 6AK5 a-m detector, V304, to prevent i-f signals from leaving the i-f assembly.

With the agc switch in the manual position, the agc voltage is shorted to ground, and the i-f gain control becomes operative. The gain-controlled stages use cathode compensation of input capacity variation with bias change.

The zero-center tuning meter operates only in FM position. Correct tuning of an a-m signal may be accomplished by first tuning in the signal with the selector switch in the FM position and then switching to the AM position.

The signal strength meter, M101, is not calibrated, although it may be used as a relative indication of signal strength. The meter is connected at a point between the third i-f amplifier and the detector when the function selector switch is in the AM position.

2.8 BEAT FREQUENCY OSCILLATOR

The 6CB6 beat frequency oscillator V111, injects a signal at 21.4 MHz into the grid of V108. This signal is variable over the useable bandwidth of the receiver i-f strip. The BFO is an electron-coupled Hartley oscillator using transformer T109 to provide feedback. Capacitor C193 is available from the front panel for purposes of providing a variable pitch control. The BFO is a completely shielded subassembly with a BFO switch, S106. The BFO switch removes B+ from V111 when the BFO is idle, and inserts R162 in parallel with R161 to readjust the current in the voltage regulator tube for the additional load when the BFO is in use.

2.9 VIDEO AMPLIFIER

The output of the i-f strip either AM or FM, is fed to the input of a 5-position lowpass filter. The cutoff frequency may be set to either 300 kHz, 30 kHz, 10 kHz, 3.0 kHz, 1.0 kHz by a front-panel selector switch, S103.

The output of the filter drives one-half of a 12AU7 direct coupled video amplifier, V117/A. A zero-center scale meter, M102, is used as a tuning indicator and is connected in a bridge circuit consisting of the video amplifier and the other half of the 12AU7, V117/B. A partial bypass of the cathode resistor of the first video amplifier extends the high frequency response. The video output amplifier is a 12AU7 dual-triode parallel connected as a direct-coupled follower. A tap on the cathode resistor of the output cathode follower video amplifier provides the signal source to drive the monitor audio amplifier.

2.10 SQUELCH CIRCUIT

The squelch circuit is best described with the aid of the simplified schematic of figure 2-1. V115/A acts as a gated audio amplifier stage, while V115/B serves as a dc amplifier and gate generator. The circuit is connected in such a manner that V115/B has zero grid voltage when no signal is being received, and has a negative signal when a carrier is being received. The audio amplifier stage, V115/A, will pass an audio signal when the dc amplifier V115/B is nonconducting, and will not pass an audio signal when V115/B is in a conducting condition. In this manner the audio circuit is disabled when insufficient carrier is being received. The signal strength necessary to make the audio section operative is adjustable by the threshold (squelch control resistor, R164. The operation of this circuit is detailed in the following paragraphs.

The dc amplifier, V115/B, is connected between the 150 volt supply and ground. The fixed bias on this stage is adjusted by R164. The audio section V115/A is connected between the 240 volt supply and the 150 volt supply. The bias on this stage is the voltage drop across the cathode resistor R-165, plus the voltage drop, if any, in R167, the plate load resistor for V115/B.

Assuming no signal is being received, the grid of the dc amplifier is at zero potential, or at most, has a very small negative voltage on it. R164 is adjusted until the noise just disappears from the output.

In this condition, the dc amplifier tube is drawing plate current, and the drop across its plate load resistor, R167, appears as a bias to audio amplifier V115/A. This voltage is sufficient to cut off V115/A and disable the audio signal. When a carrier is tuned in, a negative voltage is supplied from the second limiter in the i-f strip to the grid of V115/B. This is sufficient to cut off V115/B, causing the voltage to drop to zero across the V115/B, causing the voltage to drop to zero across the V115/B plate load resistor, R167. V115/A then receives only its normal cathode bias, generated in the cathode bias resistor R165, and audio signals are passed through to the output.

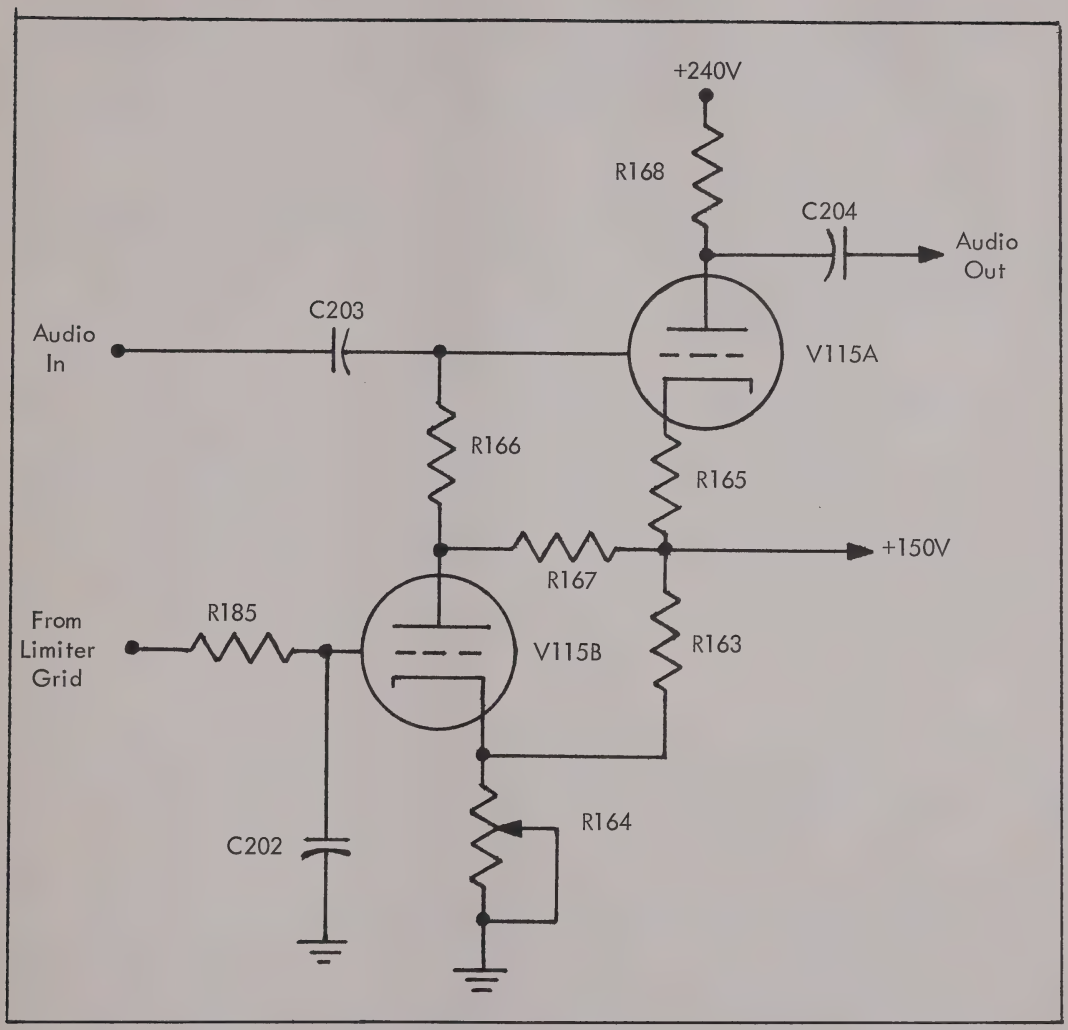


Figure 2-1. Squelch Circuit, Simplified Schematic

When receiving amplitude-modulated signals with a high percentage of modulation, the squelch circuit may be cut off on negative modulation peaks when the envelope amplitude becomes zero. To prevent this a filter consisting of R185 and C103 is placed between the limiter and the grid of the dc amplifier. This filter has a time constant long enough to reject the lowest audio frequency likely to be received, but not long enough to noticeably delay operation of the squelch.

2.11 AUDIO AMPLIFIER

The output of the gated amplifier V115/A is used to drive a two-stage resistance coupled audio amplifier. The output stage drives a four inch panel-mounted speaker, a phone jack, (which silences the speaker when in use) and an independent 600 ohm balanced output.

2.12 SPECTRUM DISPLAY UNIT OUTPUT

An output at the 21.4 MHz i-f frequency is available at the SDU output jack, J105, located on the rear apron of the receiver. This output is obtained from the 6AK5 mixer V204, through a capacity divider in conjunction with the transformer, T301, and is used to drive a Spectrum Display Unit which shows a panoramic view of adjacent frequencies on the screen of a cathode ray tube. Spectrum Display Units are available for all models.

2.13 POWER SUPPLY

The power supply of the model 2301 receiver may be operated from a source of either 115 or 230 volts, 50-400 Hz. Be sure that switch S105 is in proper position before connecting receiver to power source. The 115/230 volt line is filtered at the power input jack to prevent entrance of stray radiation.

A conventional full-wave bridge rectifier circuit using long life silicon diodes provides plate supply voltage. Filtering is accomplished through a capacitor input pi section. An 0A2 tube, V101, supplies 150 volts, regulated. Filament voltage is provided from terminals 8 and 9 of the power transformer.

SECTION III
OPERATION

3.1 INTRODUCTION

Figure 1-1 shows the appearance and location of controls on the front panel of the Model 2301 Receiver.

3.2 CONTROL SETTINGS

a. Set the line selector switch, S105, to the appropriate position. This switch is located on the rear apron of the chassis and provides for either 115 or 230 volt operation. A locking device is incorporated which prevents inadvertent switching to the wrong position.

b. Apply power to the input jack, J107, with the power cord supplied.

c. Turn on the power switch, S104, located on the front panel.

d. Turn the FM/AM switch, S101, to the desired position.

   (1) To receive an fm signal, turn S101 to the fm position. Turn the BFO switch off. The Manual AGC switch, S102, and the IF Gain control are not operative in the fm position, but the zero-center tuning meter is operative only in the fm position.

   (2) To receive an a-m signal, turn S101 to the a-m position. Turn the Manual AGC switch to the AGC position, except when using the BFO. For BFO operation, adjust the Manual IF gain control, R105, to produce the loudest beat note.

e. The video bandwidth switch, S103, has five positions: 300 kHz, 30 kHz, 10 kHz, 3 kHz, and 1 kHz. Select the position giving the best signal-to-noise ratio.

f. The squelch circuit is not operative with the squelch control, R164, in the full counterclockwise position. In the absence of a signal, rotate the squelch control clockwise until the background hiss just becomes inaudible. Any useable signal will then disable the squelch circuit and be heard.

g. Adjust the audio volume control, R170, as needed.

SECTION IV
MAINTENANCE

The Model 2301 Receiver has been fully aligned and factory tested before shipment and should give relatively trouble-free performance. In the event the unit appears to be unusually noisy, erratic, or to have unusually low sensitivity, check all rf coaxial connectors. Should this fail to improve the operation of the unit, check for a weak or faulty tube. The critical nature of UHF circuits is such that field servicing of this equipment is usually limited to vacuum tube replacement. Only a limited number of components in the rf subchassis may be replaced without disturbing critically tuned circuits. When replacing components, it is imperative that the new components have leads of identical length with those of the old component and that the physical location and arrangement of all other components and leads not be disturbed. In the event it becomes absolutely essential to align the receiver, refer to the procedure starting on the next page.

In case of breakdown, broken leads, solder joints, or loose or defective tubes should be immediately suspected and sought whenever the trouble is not immediately apparent. The voltage chart end and the overall schematic diagram contained herein will be useful in locating the cause of faulty operation. A thorough knowledge of the theory of operation and familiarity with the location of individual components are essential to successful troubleshooting. The following equipment is required for alignment:

Sweep Generator	Should cover the frequency range from 230 to 630 MHz
FM Signal Generator	Should cover the frequency range from 230 to 630 MHz.
60 MHz Marker Generator or Grid Dip Meter	
High-gain Oscilloscope	DuMont Type 304-A or equivalent
Noise Generator	PRD Type 904 or New London Model 403
21.4 MHz Post Amplifier	
50 ohm Unbalanced Detector	
Alignment Tools and BNC Connectors	
VHF Receiver	Nems-Clarke type 1302 or equivalent
Model 80 Signal Generator	

Alignment Procedure

Place AM-FM switch in FM position. Alignment and adjustment is accomplished according to the following outline, and should be carried out in the sequence given.

a. Second Limiter Alignment.

(1) C.W. Method

Step 1. Remove V302.

Step 2. Set the signal generator to 21.4 MHz and connect to pin 1 of V303.

Step 3. Connect a high-resistance voltmeter (VTVM) to the second limiter grid return (TP301).

Step 4. Set the signal generator output to produce approximately 2 volts on the VTVM.

Step 5. Detune the primary slug of T307 counterclockwise against the STOP.

Step 6. Increase the signal generator output to produce approximately the same value on the VTVM as in step 4 above.

Step 7. Adjust the secondary slug of T307 for a maximum reading on the VTVM.

Step 8. Adjust the primary slug of T307 for maximum reading, keeping the signal generator output adjusted for the same value on the VTVM as in step 4 above.

DO NOT readjust the secondary for a maximum as this will result in improper adjustment.

The second limiter transformer, T307 has an extremely wide bandwidth compared to the overall i-f bandwidth. The low circuit Q's and the heavy coupling make visual alignment of this transformer desirable but not essential. The procedure outlined above will produce less than 1 dB tilt in this transformer. Thus, the slope is negligible over the narrow i-f bandwidth.

(2) Sweep Method.

Step 1. Remove V302.

Step 2. Connect sweep generator to pin 1 of V303.

Step 3. Connect oscilloscope to second limiter grid (TP301).

Step 4. Adjust the primary and the secondary of T307 for maximum symmetrical output around the 21.4 MHz center frequency

b. Discriminator Alignment. In preparation for alignment of the discriminator transformer, T108, remove the second limiter tube, V304, and note the reading of the center frequency meter, M102. If it is off center, it should be centered by means of the potentiometer R180, located on the rear apron of the receiver and stenciled Disc. Bal. Difficulty in readily securing an exact reading is indicative of a defective discriminator tube V305, a defective audio amplifier V117, or their associated components, and must be corrected before proceeding further. After this adjustment, replace V304 and proceed as follows:

(1) C.W. Method.

Step 1. Remove V302.

Step 2. Set the signal generator to 21.4 MHz and connect to pin 1 of V303.

Step 3. Connect a high impedance VTVM to the second limiter grid return TP301.

Step 4. Set the signal generator output to produce 2.0 volts on the VTVM.

Step 5. Connect the VTVM to the discriminator output lead TP303.

Step 6. Tune the secondary of T308 to zero output, then counterclockwise until the VTVM shows a reading of 0.5 volts.

Step 7. Tune the primary of T308 to give maximum reading on the VTVM.

Step 8. Retune the secondary to produce a zero (balanced) reading on VTVM.

Step 9. Detune the signal generator above and below 21.4 MHz to produce a maximum positive and negative output. These voltages should be equal and have a magnitude of approximately 8 volts dc. Minor adjustment of the primary of T308 will cause the two peak voltages to become exactly equal.

(2) Sweep Method.

Step 1. Remove V302.

Step 2. Connect the sweep generator to pin 1 of V303.

Step 3. Connect the oscilloscope to the discriminator output lead (TP303).

Step 4. Adjust the primary and secondary slugs of T308 for maximum symmetrical output around a 21.4 MHz center frequency. The peak-to-peak separation should be 750 kHz.

c. IF Alignment.

(1) C.W. Method. The characteristics of cascaded, critically coupled amplifier stages are such as to make alignment difficult; however, the advantages of response stability, gain, and adjacent channel selectivity make this type of coupling most desirable. Alignment has been kept as simple as possible by designing the three capacitively coupled double-tuned i-f transformers, comprising T301, T302, T303, T304, T305 and T306 to have almost identical characteristics. The primary and secondary Q's have been kept high, and, therefore, the mutual coupling is low for the required bandwidth. These factors suggest a rather simple alignment procedure with a minimum of equipment. The resonant frequency of the primary or the secondary in the absence of the other (no coupling) is very nearly the proper tuning when the circuits are coupled. If the primary circuit is detuned, the secondary adjusted for maximum, the overall response will be approximately correct. This procedure is as follows:

Step 1. Remove the oscillator tube (V204) to prevent mixing at the signal generator harmonic frequencies.

Step 2. Set the receiver dial to approximately 60 MHz.

Step 3. Set the generator to 21.4 MHz and connect to pin 1 of V203.

Step 4. Connect a high-resistance dc voltmeter (VTVM) to the second limiter grid return (TP301).

Step 5. Set the generator output level to produce approximately 2V on the VTVM.

Step 6. If the i-f amplifier is known to be considerably out of adjustment, it will be necessary to peak T301, T302, T304, T305 and T306 to provide adequate gain.

Step 7. Detune the primary (T305) counterclockwise against the stop.

Step 8. Increase the signal generator output to produce 2V on the VTVM.

Step 9. Adjust the secondary T306 for maximum reading on the VTVM.

Step 10. Adjust the primary (T305) for maximum reading, keeping the signal generator output adjusted to maintain 2V on the VTVM. DO NOT readjust the secondary (T306) for a maximum as this will result in improper adjustment.

Step 11. Repeat steps 7 through 10 for T302, T303, and T304.
NOTE. It is not necessary to follow this sequence, as any transformer may be adjusted without affecting the others. The alignment may be checked by varying the signal generator frequency ±100 kHz. The output voltage should be constant with ±1 dB over this range.

(2) Sweep Method. If a sweep generator and an oscilloscope are available, they may be used to check the response; however, the above procedure should first be performed and then the response checked or retouched, as required. For this test, replace the signal generator with the sweep generator and the VTVM with the oscilloscope. Slight adjustment of the transformer slugs may give some improvement in response shape.

d. BFO Adjustment. Place FM-AM switch in AM position, AGC switch in MAN position.

Step 1. Adjust i-f gain as needed.

Step 2. Connect 21.4 MHz CW marker to TP201 (1501-A, 1503-A and 1509-A) or TP202 (1502-A and 1510-A).

Step 3. Turn BFO on and, with pitch control on reference line, adjust T109 for zero beat.

e. Local Oscillator Adjustment.

(1) Take bottom cover off rf section. Turn on the set and allow it to warm up for at least thirty minutes.

(2) Turn the dial to the high end stop. Adjust the oscillator trimmer, C213, to set the oscillator frequency at 562 MHz.

(3) Turn the dial to the low end stop. Adjust the inductance of shunt coil, L206, to set the oscillator frequency at 307 MHz.

(4) Turn the dial to high end and adjust C214 for proper tracking. Now go back to low end and reset L206, if necessary.

(5) Repeat step 4 until proper tracking is obtained.

(6) Check the oscillator injection voltage through the entire tuning range by measuring the biasing voltage developed at TP201. If at any point the injection voltage drops below -0.75 volt, change the oscillator tube.

f. Mechanical Adjustments. Caution. Normally no adjustments are necessary to the gear train, however, if the above local oscillator adjustments do not produce the proper tracking of the tuning dial, refer to the following procedure:

Step 1. Loosen both gear train stops.

Step 2. Rotate dial to the extreme low-frequency end until the dial is stopped by the inductuner stop. Hairline should align with triangle on dial.

Step 3. Back up just off the inductuner stop and tighten the set screws in the dial drive low-frequency stop.

Step 4. Rotate the dial to the extreme high-frequency end until the dial is stopped by the inductuner stop. The hairline should align with the triangle, on the dial, if not, loosen the screws on the inductuner shaft and align the triangle.

Step 5. Retighten the screws on the inductuner shaft.

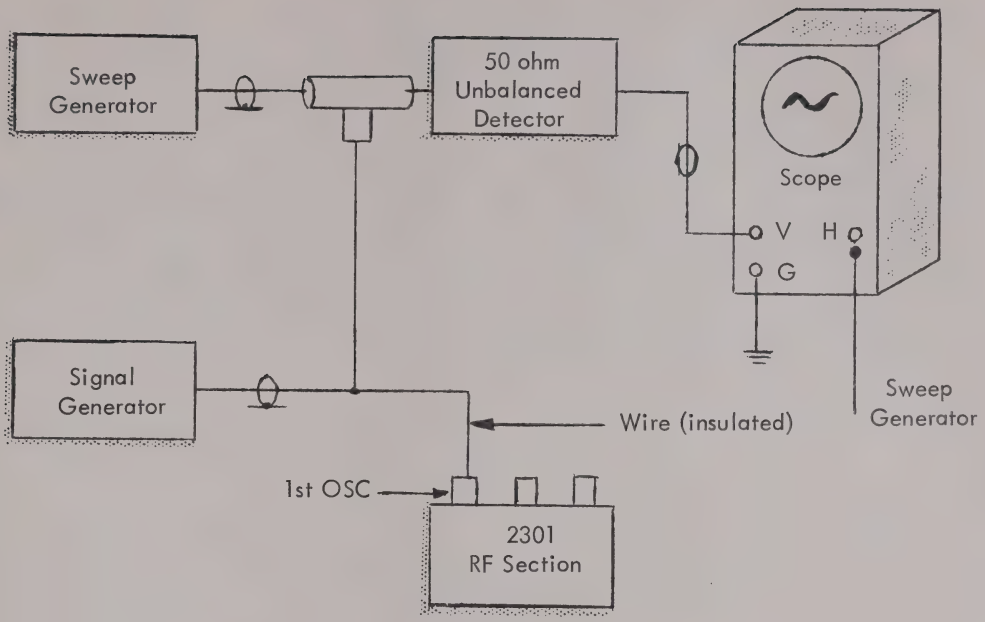
Step 6. Back up just off the inductuner stop and tighten the set screws in the dial drive low-frequency mechanical stop.

g. RF Alignment. As in any high frequency equipment, the lead length and the placement of the components associated with the tuning circuit are critical in as far as frequency response and range are concerned. This is especially true with the 2301 front end, as the tubes employed are operated very close to their frequency limits. Therefore, the dressing of the components requires special care and their electrical effects need be familiarized.

Step 1. Connect the 60 MHz output of the first converter to a VHF receiver, such as a NEMS-Clarke Type 1302. Use a 50 ohm coaxial cable and set the receiver to 60 MHz. Then feed 60 MHz CW from a signal generator, such as a Measurement Corporation Model 80, to the grid of the first mixer, V202. Tune output coil L204 for maximum indication shown on the signal strength meter of the VHF receiver or the output meter of its associated post amplifier. Disconnect the cable after L204 has been set.

Step 2. Connect the output of the sweep generator to the input of the 2301 unit through a 50 ohm coaxial, and again connect a piece of coaxial from the test point TP201 to the vertical input of a high gain oscilloscope. The horizontal output of the sweep generator is to be connected to the x-input of the scope. Then set both the sweep generator and the 2301 at 502 MHz. Use lowest workable output from the sweep generator to prevent overloading and word with a three-inch picture on the scope.

Step 3. Adjust both plate and mixer trimmers, C211 and C212 to obtain a double tuned response. Oscillator tracking can be visualized either by coupling a 60 MHz marker loosely to the double tuned circuit or by observing the 60 MHz marker as reflected from the plate coil, L204. If the frequency of 502 MHz cannot be reached with the plate trimmer adjust the position of C207. Bringing C207 closer to the chassis will raise the tuning frequency.



Step 4. Turn both the sweep generator and the 2301 slowly toward the low end and observe the response. Stop turning when 300 MHz is reached and adjust C212 for the best symmetrical response pattern. Now proceed on to the low end of the dial and adjust L202 and L205 for a symmetrical response centered at 247 MHz.

Step 5. Now turn sweep generator and tuner back to 300 MHz and readjust C212 if necessary. Proceed to high end of dial and adjust the lead which connects to C212 and the inductuner. It may be necessary to shorten this lead by soldering a shorter connection to the trimmer. This lead must be adjusted for best response at 502 MHz.

Step 6. Repeat procedures 4 and 5 until desired response is obtained. If trouble arises, repeat procedures 3, 4, and 5.

Step 7. Go over entire tuning range slowly and observe the response and oscillator tracking C214, adjusts the high end tracking while L206 determines the low end. Oscillator tracking should be such that the 60 MHz marker will stay within 25 percent on either side of the response.

Step 8. After aligning the unit, cement the shunt coils L202 and L205 with either wax or a suitable glue.

Step 9. Do not disconnect cables upon completion of the above steps.

h. Alignment of Second Converter. The second converter has a crystal oscillator. The crystal overtone frequency is 81.4 MHz and this oscillator frequency is inductively coupled to the grid circuit of V204, the second mixer. The output of the first mixer, 60 MHz, after passing through a lowpass filter configuration is capacitively coupled along with the 81.4 MHz signal to the grid of V204. The resultant IF output of 21.4 MHz is then obtained. Since L204 and L211 pass the 60 MHz i-f, it is essential that the double tuned response be centered at 60 MHz.

Step 1. With a VTVM, measure the negative dc, voltage developed at TP203 and leave probe connected. Adjust L212 for maximum negative voltage at this point, -4 to -7 volts.

Step 2. Obtain a workable pattern on the scope by setting the dial and sweep generator to the same frequency. Disconnect coaxial from TP201 and connect it to TP202. Connect a short piece of RG-55 from J202 to J203. Inject a 60 MHz marker at V202 with a grid dip meter on suitable marker. Apply B+ through a 10k resistor to pin 5 of V204.

Step 3. Retune coil L212 for a maximum indication on the voltmeter. Disconnect VTVM probe.

This completes the alignment procedures.

Table 4-1. Tube Voltage Chart for 2301 Receiver

Tube	Type	1	2	3	4	5	6	7	8	9
V101	0A2	150	N.C.	N.C.	N.C.	150	N.C.	Gnd	-	-
V102	12AU7	143	-1.1	25	Gnd	Gnd	227	133	150	6.3 AC
V103	12AU7	102	0	6.6	Gnd	Gnd	257	0.1	0.95	6.3 AC
V104	12AU7	143	Gnd	7.1	Gnd	Gnd	155	0	7.1	6.3 AC
V105	12AU7	257	155	158	Gnd	Gnd	257	155	158	6.3 AC
V106	6CB6	-10.8	0	6.3	Gnd	143	125	Gnd	-	-
V201	5842/ 417A	140 (1)	Gnd	Gnd	Gnd	Gnd	1.7	Gnd	Gnd	6.3 AC
V202	6AK5	-3.0 min.	Gnd	6.3 AC	Gnd	135	35	Gnd	-	-
V203	6AF4A	80	Do Not Meas.	6.3 AC	0	0	Do Not Meas.	80	-	-
V204	6AK5	-1.0 (2)	Gnd	6.3 AC	Gnd	150	85	Gnd	-	-
V205	6BQ7A	110	-5.0 (3)	1.3	6.3 AC	Gnd	100	Gnd	1.3	Gnd
V301	6DC6	-.43	.78	6.3 AC	Gnd	143	90	Gnd		
V302	6DC6	-.43	.78	6.3 AC	Gnd	143	63	Gnd		
V303	6CB6	-.38	.14	6.3 AC	Gnd	143	37	Gnd		
V304	6AK5	-8.7	Gnd	6.3 AC	Gnd	34.5	59	Gnd		
V305	6AL5	-4.3	-5.9	Gnd	5.0 AC	Gnd	Gnd	Gnd		

NOTE

Line voltage 115V AC, 60 Hz; Dial tuned to 500 MHz; no signal input; squelch control and audio gain control full CCW; AGC on; BFO off except for measurements on V106; all voltages measured with respect to ground with high impedance VTVM.

(1) Measured at TP201.
(2) Measured at TP202.
(3) Measured at TP203.

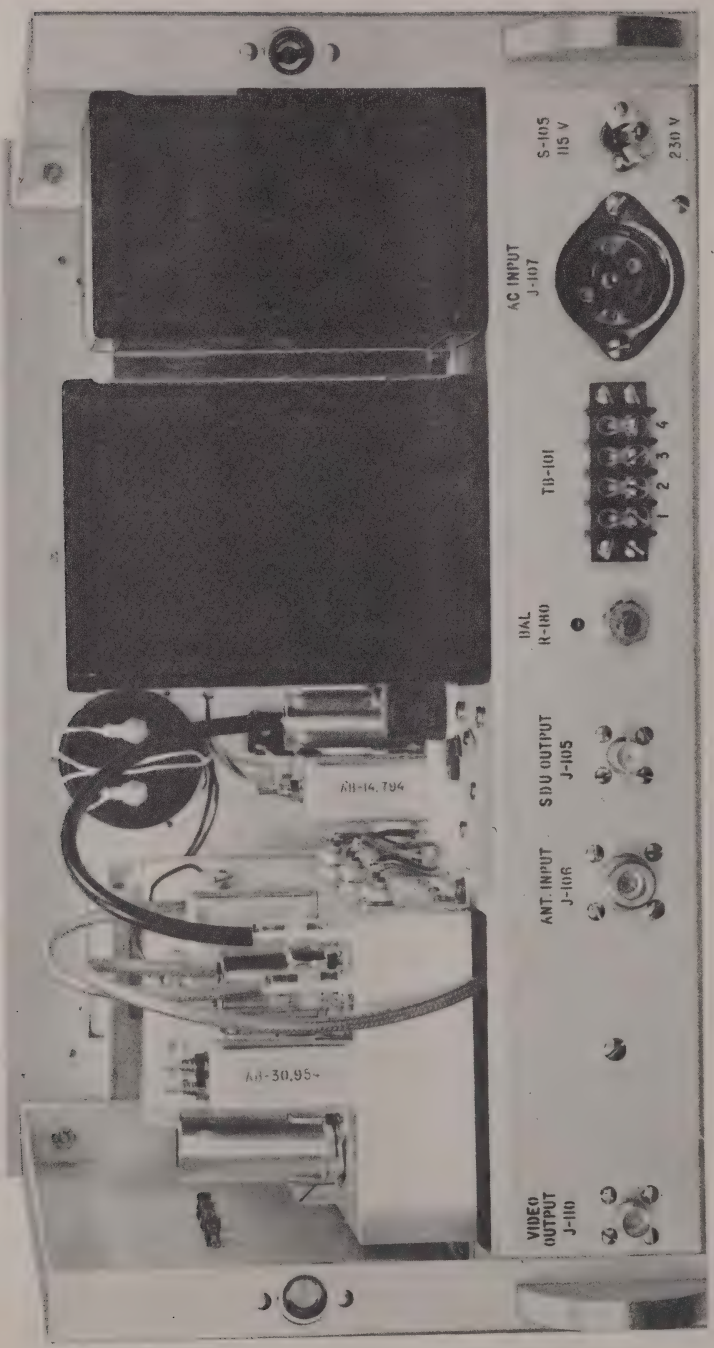


Figure 4-1. 2301 Receiver, Rear View

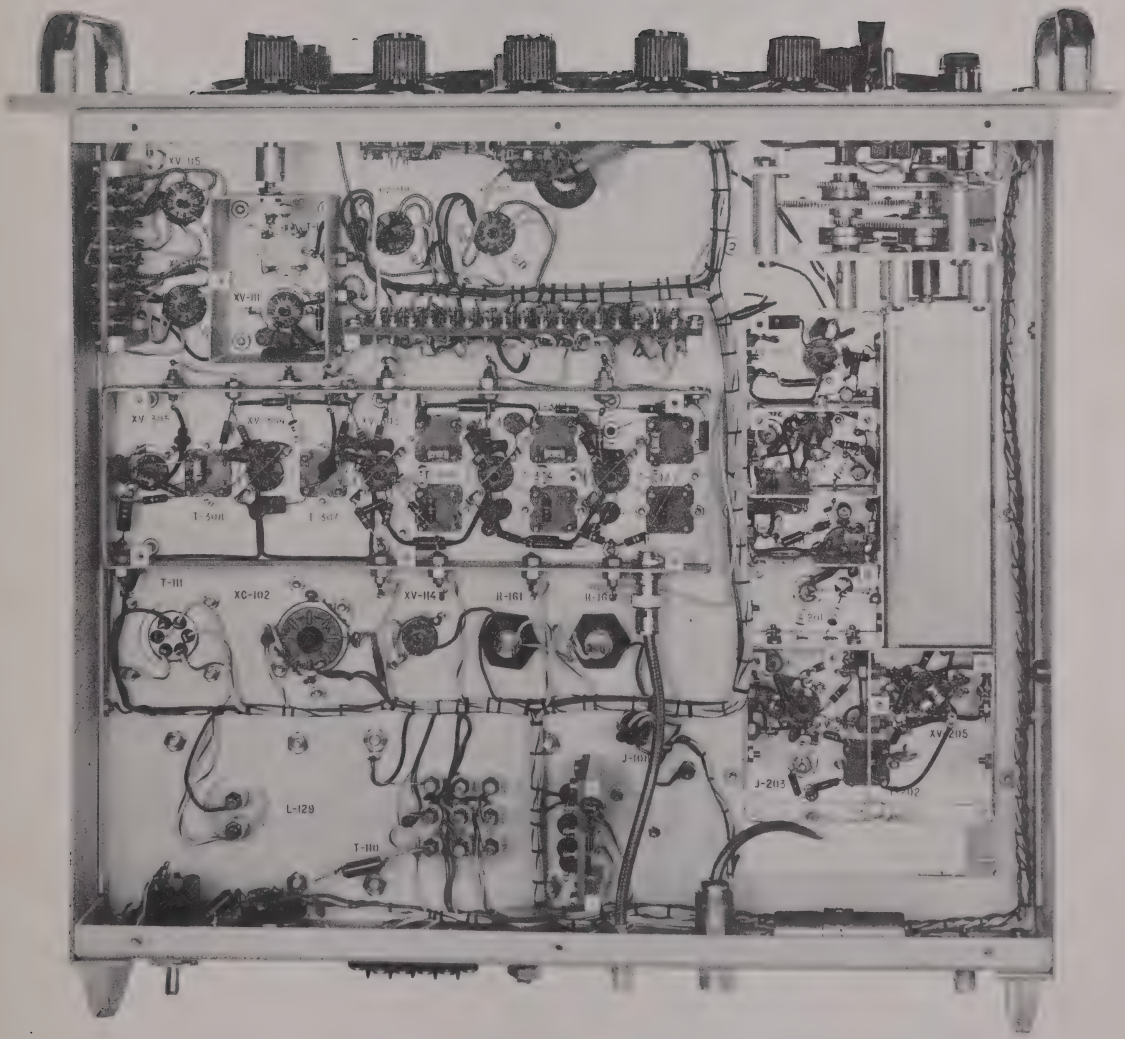


Figure 4-2. 2301 Receiver, Bottom View

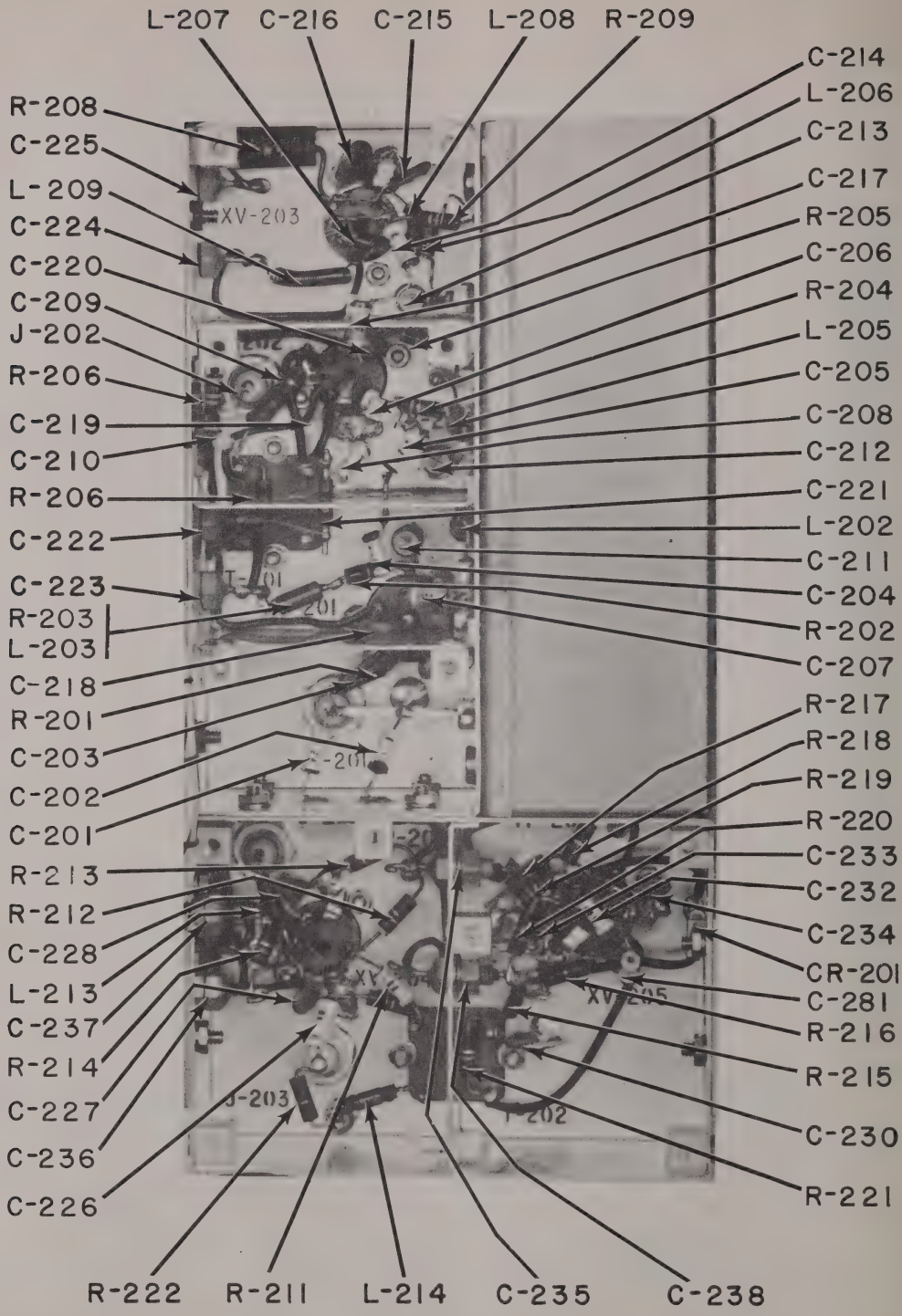


Figure 4-3. RF Section, 2301 Receiver

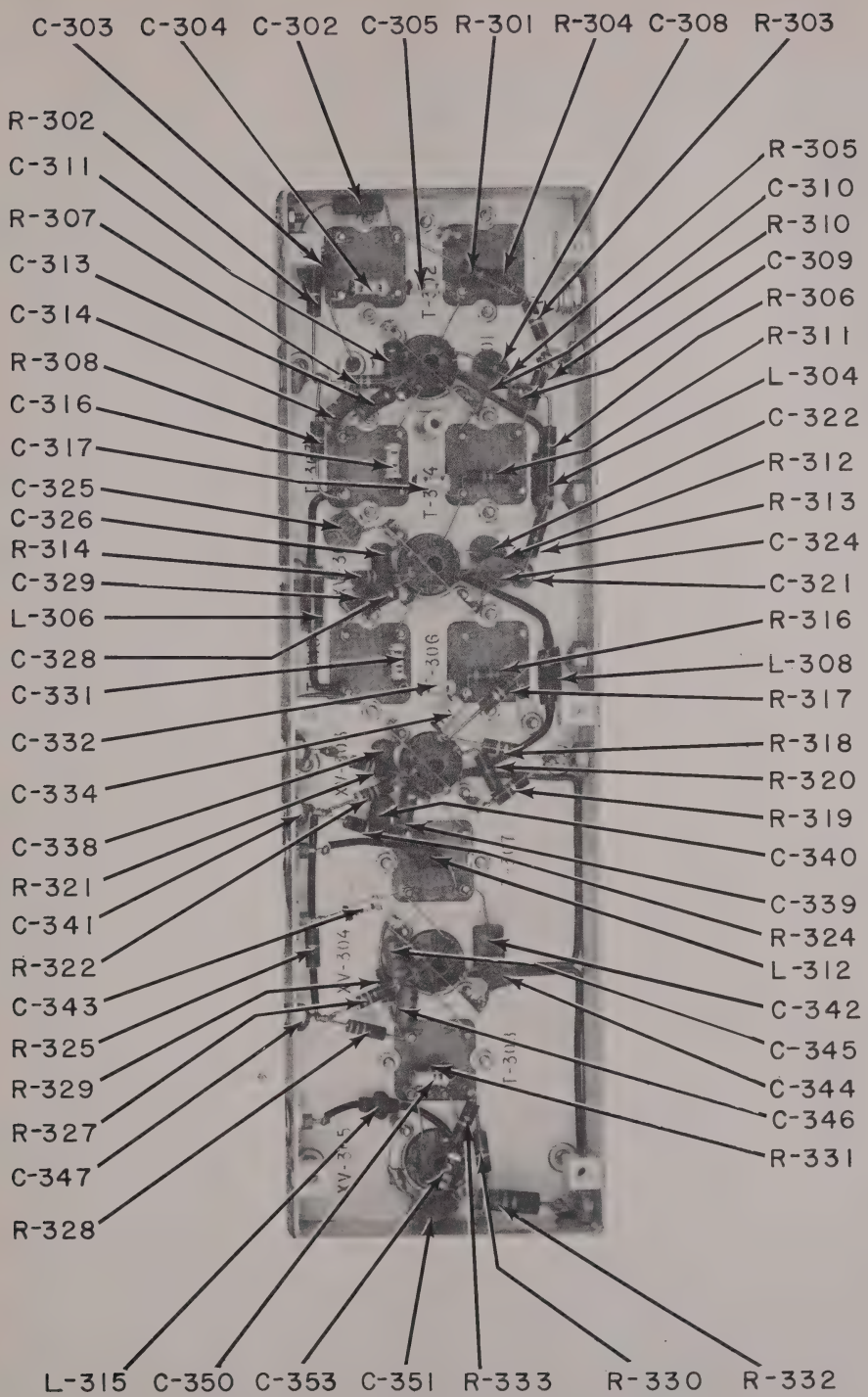


Figure 4-4. IF Section, 2301 Receiver

SECTION V
PARTS LIST

Reference Designation	Description
C101	Not assigned
C102A	Capacitor, electrolytic, 35 μF, 450V, Sprague CE52F350R
C102B	Capacitor, electrolytic, 35 μF, 450V, Sprague CE52F350R
C103	Capacitor, fixed, ceramic, 0.05 μF ±20%, 200V, Aerovox P-82
C104 through C106	Capacitor, fixed, ceramic, 0.01 μF, GMV, 500V, Sprague 29C9B8
C107	Capacitor, fixed, mica, 300 pF ±5%, 500V, Elmenco CM15E301J
C108	Capacitor, paper, 1.0 μF, 400V, Sprague 88P10504T13
C109	Capacitor, fixed, ceramic, 1000 pF, GMV, 500V, Sprague 514C1
C110	Capacitor, ceramic, 0.0047 μF, MRC, 500V, Sprague 20C8
C111	Capacitor, ceramic, 0.0047 μF, MRC, 500V, Sprague 20C8
C112 through C185	Not assigned
C186	Capacitor, mica, fixed, 0.1 μF ±5%, 200V, Elmenco CM15E102J
C187	Capacitor, fixed, ceramic, 0.01 μF, GMV, 500V, Sprague 29C9B8
C188	Capacitor, ceramic, tubular, 56 pF ±10%, 500V, Erie NPO-A
C189	Capacitor, ceramic, tubular, 43 pF ±10%, 500V, Erie NPO-A
C190	Capacitor, ceramic, tubular, 220 pF ±10%, 500V, Erie NPO-A
C191	Capacitor, ceramic, tubular, 750 pF ±10%, 500V, Erie NPO-A
C192	Capacitor, ceramic, tubular, 2200 pF ±10%, 600V, Eroe NPO-A
C193	Capacitor, variable, Air Dielectric 1.5-5.2 pF
C194	Part of T109
C195	Part of T109
C196	Capacitor, ceramic, disc, 0.001 μF, GMV, 1000V, Sprague 40C230A
C197	Capacitor, ceramic, 51 pF ±10%, 500V, Erie NPO-A
C198	Capacitor, ceramic, disc, 0.001 μF, GMV, 1000V, Sprague 40C230A
C199	Capacitor, fixed, ceramic, 1000 pF, GMV, 500V, Sprague 514C1

Reference Designation	Description
C200	Not assigned
C201	Capacitor, ceramic, tubular, 2.2 pF ±0.1 pF, 500V, Erie NPO-A
C202	Capacitor, ceramic, tubular, 3.3 pF ±0.1 pF, 500V, Erie NPO-A
C203	Capacitor, ceramic, disc, 0.01 μF, GMV, 500V, Sprague 29C9B8
C204	Capacitor, ceramic, tubular, 68 pF ±0.1 pF, 500V, Erie NPO-A
C205	Capacitor, ceramic, tubular, 1.0 pF ±0.1 pF, 500V, Erie NPO-A
C206	Capacitor, ceramic, tubular, 3.9 pF ±0.25 pF, 500V, Erie NPO-A
C207	Capacitor, ceramic, tubular, 100 pF ±10%, 500V, Erie N-1400-A
C208	Capacitor, ceramic, tubular, 3.9 pF ±0.25 pF, 500V, Erie NPO-A
C209	Capacitor, ceramic, tubular, 33 pF ±10%, 500V, Erie NPO-332
C210	Capacitor, ceramic, tubular, 470 pF ±10%, 500V, Erie GP2-A
C211 through C213	Capacitor, variable, 0.5-4.5 pF, 500V, CTC #CST-6
C214	Capacitor, ceramic, tubular, 3.9 pF ±0.5 pF, 500V, Erie N470A
C215	Capacitor, ceramic, disc, 0.0047 μF, MRC, 500V, Sprague 20C8
C216	Capacitor, ceramic, disc, 0.0047 μF, MRC, 500V, Sprague 20C8
C217	Capacitor, ceramic, tubular, 1.0 pF ±0.1 pF, 500V, Erie NPO-A
C218 through C220	Capacitor, ceramic, disc, 0.001 μF, GMV, 1000V, Sprague 40C230A
C221 through C225	Capacitor, ceramic, feedthru, 1000 pF, 500V, Sprague 514C1
C226	Capacitor, ceramic, disc, 47 pF, 500V, Sprague 20C8
C227	Capacitor, ceramic, tubular, 470 pF ±10%, 500V, Erie GP2-A
C228 through C230	Capacitor, ceramic, disc, 0.001 μF, GMV, 1000V, Sprague 40C230A
C231	Capacitor, ceramic, tubular, 3.3 pF ±0.1 pF, 500V, Erie NPO-A
C232	Capacitor, tubular, 10 pF ±10%, Erie NPO
C233	Capacitor, ceramic, disc, 0.001 μF, GMV, 1000V, Sprague 40C230A
C234	Capacitor, ceramic, disc, 0.001 μF, GMV, 1000V, Sprague 40C230A

Reference Designation	Description
C235 through C238	Capacitor, ceramic, feedthru, 1000 pF, 500V, Sprague 514C1
C239 through C300	Not assigned
C301	Part of T301
C302	Capacitor, ceramic, 220 pF ±5%, 500V, Erie NPO-A
C303	Capacitor, ceramic, 4700 pF ±5%, 500V, Erie NPO-A
C304	Capacitor, ceramic, tubular, 2.2 pF ±0.1 pF, 500V, Erie NPO-A
C305	Capacitor, ceramic, tubular, 2.2 pF ±0.1 pF, 500V, Erie NPO-A
C306	Capacitor, ceramic, 39 pF ±5%, 500V, Erie NPO-A
C307	Part of T302
C308	Capacitor, ceramic, 4700 pF ±5%, 500V, Erie NPO-A
C309	Capacitor, ceramic, disc, 0.001 uF, GMV, 1000V, Sprague 40C230A
C310	Capacitor, ceramic, 4700 pF ±5%, 500V, Erie NPO-A
C311	Capacitor, ceramic, 500 pF ±10%, 500V DC, Erie GP2-331
C312	Capacitor, ceramic, feedthru, 1000 pF, 500V DC, Sprague 514C1
C313	Capacitor, ceramic, 500 pF ±10%, 500V DC, Erie GP2-331
C314	Capacitor, ceramic, 390 pF ±10%, 500V DC, Erie GP2-331
C315	Part of T303
C316	Capacitor, ceramic, 1.5 pF ±1%, 500V DC, Erie NPO-A
C317	Capacitor, ceramic, 1.8 pF ±1%, 500V DC, Erie NPO-A
C318	Part of T304
C319	Part of T304
C320	Capacitor, ceramic, feedthru, 1000 pF, 500V DC, Sprague 514C1
C321	Capacitor, ceramic, disc, 0.001 uF, GMV, 1000V, Sprague 40C230A
C322	Capacitor, ceramic, 4700 pF ±5%, 500V, Erie NPO-A
C323	Capacitor, ceramic, feedthru, 1000 pF, 500V DC, Sprague 514C1
C324	Capacitor, ceramic, 4700 pF ±5%, 500V, Erie NPO-A
C325	Capacitor, ceramic, 4700 pF ±5%, 500V, Erie NPO-A

Reference Designation	Description
C326	Capacitor, ceramic, 500 pF ±10%, 500V, DC, Erie GP2-331
C327	Capacitor, ceramic, feedthru, 1000 pF, 500V DC, Sprague 514C1
C328	Capacitor, ceramic, 500 pF ±10%, 500V, DC, Erie GP2-331
C329	Capacitor, ceramic, 390 pF ±10%, 500V DC, Erie GP2-331
C330	Part of T305
C331	Capacitor, ceramic, 1.5 pF ±1%, 500V DC, Erie NPO-A
C332	Capacitor, ceramic, 1.8 pF ±1%, 500V DC, Erie NPO-A
C333	Part of T306
C334	Capacitor, ceramic, 22 pF ±10%, 500V DC, Erie NPO-A
C335 through C337	Capacitor, ceramic, feedthru, 1000 pF, 500V DC, Sprague 514C1
C338 through C340	Capacitor, ceramic, 500 pF ±10%, 500V, DC, Erie GP2-331
C341	Capacitor, ceramic, disc, 0.001 μF, GMV, 1000V, Sprague 40C230A
C342	Capacitor, mica, 33 pF ±5%, 500V DC, Elmenco DM15E330J
C343	Capacitor, ceramic, 1 pF ±10%, 500V DC, Erie NPO-A
C344	Capacitor, ceramic, 4700 pF ±5%, 500V, Erie NPO-A
C345	Capacitor, ceramic, 1000 pF ±20%, 600V DC, Centralab D6-102
C346	Capacitor, ceramic, 1000 pF ±20%, 600V DC, Centralab D6-102
C347	Capacitor, ceramic, 4700 pF ±5%, 500V, Erie NPO-A
C348	Part of T308
C349	Part of T308
C350	Capacitor, ceramic, 39 pF ±5%, 500V DC, Erie N470-A
C351	Capacitor, ceramic, 0.01 μF, GMV, 500V DC, Sprague 29C9B8
C352	Capacitor, ceramic, feedthru, 1000 pF, 500V DC, Sprague 514C1
C353	Capacitor, ceramic, 27 pF ±10%, 500V DC, Erie N220-A
CR101 through CR104	Crystal, rectifier, 1N539

Reference Designation	Description
CR105	Crystal, diode, 1N457
CR106 through CR200	Not assigned
CR201	Crystal type CR-56μ/m Crystals 81.400 McCoy M-20
F101	Fuse, 1.25 amp, Slo-Blo Bussman MDL
F102	Fuse, 6 amp, Slo-Blo, Bussman MDL
J101 through J104	Not assigned
J105	Connector, jack, bnc, UG-291/U
J106	Connector, receptacle, UG-1052/U
J107	Receptacle, Hubbell 7486
J108	Receptacle, Winchester M7S-LRM
J109	Jack, telephone, Switchcraft C-12A
J110	Connector, UG-290/U IPC 2700
J111 through J200	Not assigned
J201 through J204	Connector, UG-1094/U
J205 through J301	Not assigned
J302	Connector, receptacle, Amphenol UG-1094/U
L201	Strap, Nems-Clarke A18969
L202	Coil, Nems-Clarke AA23252-1
L203	Coil winding, Nems-Clarke AA18974
L204	Coil, Part of T201

Reference Designation	Description
L205	Coil, Nems-Clarke AA23252-2
L206	Coil, Nems-Clarke A23255
L207	Coil winding, Nems-Clarke A18972-1
L208	Coil winding, Nems-Clarke A18972-2
L209	Coil winding, Nems-Clarke A18972-3
L210A-D	Inductuner assembly, 4 section, modified per Nems-Clarke B31103
L211	Part of T202
L212	Part of T202
L213	Coil, Nems-Clarke AA23254-2
L214	Coil, Nems-Clarke AA23254-1
L215	Strap, Nems-Clarke A23217
L216 through L300	Not assigned
L301	Part of T301
L302	Part of T302
L303	Part of T303
L304	Choke, Nems-Clarke AA16625
L305	Part of T304
L306	Choke, Nems-Clarke AA14805
L307	Part of T305
L308	Choke, Nems-Clarke AA16625
L309 through L311	Part of T307
L312	Choke, Nems-Clarke AA14804
L313	Part of T308
L314A, B	Part of T308
L315	Choke, Nems-Clarke AA14804
LS101	Speaker, RCA 214S1

Reference Designation	Description
M101	Meter, Marion 52N (0-50)
M102	Meter, Marion 52N (100-0-100)
P101 through P106	Not assigned
P107	Part of Power Cord, Nems-Clarke A19709
P108 through P110	Not assigned
P111	Part of Power Cord, Nems-Clarke A19709
P112 through P200	Not assigned
P201 through P204	Connector, plug, bnc, UG-88/U
P205 through P300	Not assigned
P301	Not assigned
P302	Connector, plug, bnc, UG-88/U
R127	Resistor, variable, 10k ±20%, 2W, Allen Bradley JU1032
R128	Resistor, fixed composition, 330k ±10%, 1/2W, Allen Bradley EB3341
R129	Not assigned
R130	Not assigned
R131	Resistor, fixed composition, 20M ±10%, 1/2W, Allen Bradley EB2061
R132 through R137	Not assigned
R138	Resistor, fixed composition, 47k ±10%, 1/2W, Allen Bradley EB4731
R139 through R141	Not assigned

Reference Designation	Description
R142	Resistor, fixed composition, 470k ±10%, 1/2W, Allen Bradley EB4741
R143	Not assigned
R144	Resistor, fixed composition, 24k ±5%, 1/2W, Allen Bradley EB2435
R145	Resistor, fixed composition, 330k ±10%, 1/2W, Allen Bradley EB3341
R146 through R148	Not assigned
R149	Resistor, fixed composition, 100k ±10%, 1/2W, Allen Bradley EB1041
R150 through R153	Not assigned
R154	Resistor, fixed composition, 220k ±10%, 1/2W, Allen Bradley EB2241
R155	Resistor, Part of T109
R156	Resistor, fixed composition, 10k ±10%, 1/2W, Allen Bradley EB1031
R157	Resistor, fixed composition, 1000Ω ±10%, 1/2W, Allen Bradley EB1021
R158	Resistor, fixed composition, 10k ±10%, 1/2W, Allen Bradley EB1031
R159	Not assigned
R160	Resistor, power, 2k ±3%, 25W, Dalohm PH-25
R161	Resistor, wirewound, 2.5k ±3%, 25W, Dalohm PH-25
R162	Resistor, fixed composition, 20k ±10%, 1W, Allen Bradley GB2031
R163	Resistor, fixed composition, 47k ±10%, 2W, Allen Bradley HB4731
R164	Resistor, variable, 10k ±20%, 2W, Allen Bradley JU1032
R165	Resistor, fixed composition, 2k ±10%, 1/2W, Allen Bradley EB2021
R166	Resistor, fixed composition, 1M ±10%, 1/2W, Allen Bradley EB1051
R167	Resistor, fixed composition, 240k ±10%, 1/2W, Allen Bradley EB2441
R168	Resistor, fixed composition, 22k ±10%, 1/2W, Allen Bradley EB2231
R169	Resistor, fixed composition, 470k ±10%, 1/2W, Allen Bradley EB4741
R170	Resistor, variable, 0.25 Meg ±20%, 2W, Allen Bradley JU2542
R171	Resistor, fixed composition, 10k ±10%, 1/2W, Allen Bradley EB1031
R172	Resistor, fixed composition, 1k ±10%, 1/2W, Allen Bradley EB1021
R173	Resistor, fixed composition, 1M ±10%, 1/2W, Allen Bradley EB1051

Reference Designation	Description
R174	Resistor, fixed composition, 220k ±10%, 1/2W, Allen Bradley EB2241
R175	Resistor, fixed composition, 3300Ω ±5%, 1/2W, Allen Bradley EB3325
R176	Resistor, fixed composition, 15k ±10%, 1/2W, Allen Bradley EB1531
R177	Resistor, fixed composition, 47k ±10%, 1/2W, Allen Bradley EB4731
R178	Resistor, fixed composition, 3300Ω ±5%, 1/2W, Allen Bradley EB3325
R179	Resistor, fixed composition, 22k ±10%, 1/2W, Allen Bradley EB2231
R180	Resistor, variable, 50k, ±20%, 2W, Allen Bradley JLU5032
R181	Resistor, fixed composition, 10k ±10%, 1W, Allen Bradley GB1031
R182	Resistor, fixed composition, 6800Ω ±10%, 1W, Allen Bradley GB6821
R183	Resistor, fixed composition, 100k ±10%, 1/2W, Allen Bradley EB1041
R184	Resistor, fixed, 1 meg ±10%, 1/2W, Allen Bradley EB1051
R185	Resistor, fixed, 1 meg ±10%, 1/2W, Allen Bradley EB1051
R186 through R189	Not assigned
R190	Resistor, fixed composition, 33k ±5%, 1/2W, Allen Bradley EB3335
R191 through R200	Not assigned
R201	Resistor, fixed composition, 68Ω ±5%, 1/2W, Allen Bradley EB6805
R202	Resistor, fixed composition, 150Ω ±10%, 1/2W, Allen Bradley EB1511
R203	Part of L203
R204 through R206	Resistor, fixed composition, 470k ±10%, 1/2W, Allen Bradley EB4741
R207	Resistor, fixed composition, 10k ±5%, 1/2W, Allen Bradley EB1035
R208	Resistor, fixed composition, 6800Ω ±5%, 2W, Allen Bradley HB6825
R209	Resistor, fixed composition, 100k ±10%, 1/2W, Allen Bradley EB1041
R210	Resistor, fixed composition, 680k ±10%, 1/2W, Allen Bradley EB6841
R211	Resistor, fixed composition, 22k ±10%, 1/2W, Allen Bradley EB2231
R212	Resistor, fixed composition, 470k ±10%, 1/2W, Allen Bradley EB4741
R213	Resistor, fixed composition, 470k ±10%, 1/2W, Allen Bradley EB4741

Reference Designation	Description
R214	Resistor, fixed composition, 47k ±10%, 1/2W, Allen Bradley EB4731
R215	Resistor, fixed composition, 10k ±5%, 1/2W, Allen Bradley EB1035
R216	Resistor, fixed composition, 270Ω ±5%, 1/2W, Allen Bradley EB2715
R217	Resistor, fixed composition, 270Ω ±5%, 1/2W, Allen Bradley EB2715
R218	Resistor, fixed composition, 1M ±10%, 1/2W, Allen Bradley EB1051
R219	Resistor, fixed composition, 470k ±10%, 1/2W, Allen Bradley EB4741
R220	Resistor, fixed composition, 10k ±5%, 1/2W, Allen Bradley EB1035
R221	Resistor, fixed composition, 22k ±10%, 1/2W, Allen Bradley EB2231
R222	Resistor, fixed composition, 22Ω ±5%, 1/2W, Allen Bradley EB2205
R223 through R300	Not assigned
R301	Resistor, 51Ω ±5%, 1/2W, Allen Bradley EB5105
R302	Resistor, 1k ±10%, 1/2W, Allen Bradley EB1021
R303	Resistor, 220k ±10%, 1/2W, Allen Bradley EB2241
R304	Resistor, 10k ±5%, 1/2W, Allen Bradley EB1035
R305	Resistor, 82Ω ±5%, 1/2W, Allen Bradley EB8205
R306	Resistor, 82Ω ±5%, 1/2W, Allen Bradley EB8205
R307	Resistor, 47k ±10%, 1/2W, Allen Bradley EB4731
R308	Resistor, 100Ω ±10%,1/2W, Allen Bradley EB1011
R309	Part of T303
R310	Resistor, 220k ±10%, 1/2W, Allen Bradley EB2241
R311	Resistor, 20k ±5%, 1/2W, Allen Bradley EB2035
R312	Resistor, 82Ω ±5%, 1/2W, Allen Bradley EB8205
R313	Resistor, 82Ω ±5%, 1/2W, Allen Bradley EB8205
R314	Resistor, 150k ±10%, 1/2W, Allen Bradley EB1541
R315	Part of T305
R316	Resistor, 30k ±5%, 1/2W, Allen Bradley EB3035
R317	Resistor, 820k ±10%, 1/2W, Allen Bradley EB8241
R318	Resistor, 100k ±10%, 1/2W, Allen Bradley EB1041
R319	Resistor, 10k ±10%, 1/2W, Allen Bradley EB1031

Reference Designation	Description
R320	Resistor, 51Ω ±5%, 1/2W, Allen Bradley EB5105
R321	Resistor, 22k ±10%, 1/2W, Allen Bradley EB2231
R322	Resistor, 47k ±10%, 1/2W, Allen Bradley EB4731
R323	Part of T307
R324	Resistor, 1k ±10%, 1/2W, Allen Bradley EB1021
R325	Resistor, 1k ±10%, 1/2W, Allen Bradley EB1021
R326	Part of T307
R327	Resistor, 33k ±5%, 1/2W, Allen Bradley EB3335
R328	Resistor, 33k ±5%, 1/2W, Allen Bradley EB3335
R329	Resistor, 47k ±10%, 1/2W, Allen Bradley EB4731
R330	Resistor, 100k ±5%, 1/2W, Allen Bradley EB1045
R331	Resistor, 10k ±5%, 1/2W, Allen Bradley EB1035
R332	Resistor, 4.7Ω ±5%, 1W, Allen Bradley GB-4R75
R333	Resistor, 100k ±5%, 1/2W, Allen Bradley EB1045
S101	Switch, rotary, modified per Nems-Clarke A14800-2
S102	Switch, toggle, spdt, Smith 521
S103	Switch, rotary, modified per Nems-Clarke A14801
S104	Switch, toggle, spst, Smith 520
S105	Switch, toggle, spdt, Smith 521
S106	Switch, toggle, dpst, Smith 522
T101 through T108	Not assigned
T109	Transformer, IF, Nems-Clarke AB14798
T110	Transformer, power, Nems-Clarke AC18227
T111	Transformer, audio, Nems-Clarke AB14487
T112 through 300	Not assigned

Reference Designation	Description
T301	Transformer, IF, Nems-Clarke AB14796
T302	Transformer, IF, Nems-Clarke AB14794
T303	Transformer, IF, Nems-Clarke AB14797
T304	Transformer, IF, Nems-Clarke AB14795
T305	Transformer, IF, Nems-Clarke AB14797
T306	Transformer, IF, Nems-Clarke AB14793
T307	Transformer, limiter, Nems-Clarke AB14799
T308	Transformer, discriminator, Nems-Clarke AB14976
TB101	Terminal strip, Cinch Jones 4-140-Y
TP102 through TP200	Not assigned
TP201	Test Jack, Sealectro SKT-5BC-White
TP202	Test Jack, Sealectro SKT-5BC-White
TP203	Test Jack, Sealectro SKT-5BC-White
V101 through V110	Not assigned
V111	Tube, electron, 6CB6
V112	Not assigned
V113	Not assigned
V114	Tube, electron, 0A2
V115 through V118	Tube, electron, 12AU7
V119 through V200	Not assigned
V201	Tube, electron, Western Electric 5842/417A
V202	Tube, electron, 6AK5
V203	Tube, electron, 6AF4A

Reference Designation	Description
V204	Tube, electron, 6AK5
V205	Tube, electron, 6BQ7A
V206 through V300	Not assigned
V301	Tube, electron, 6DC6
V302	Tube, electron, 6DC6
V303	Tube, electron, 6CB6
V304	Tube, electron, 6AK5
V305	Tube, electron, 6AL5
XC102	Socket, TS101P01
XF101	Fuseholder, Bussman HKP
XF102	Fuseholder, Bussman HKP
XV101 through XV110	Not assigned
XV111	Socket, electron tube, 7 pin miniature Elco BR-151-BC
XV112	Not assigned
XV113	Not assigned
XV114	Socket, tube, Elco BR-151-BC
XV115 through XV118	Socket, tube, Elco BR-283-BC
XV119 through XV200	Not assigned
XV201	Tube socket, 9 pin miniature Mycalex 90A299
XV202	Tube socket, 7 pin miniature, Mycalex 70A403
XV203	Tube socket, 7 pin miniature, TS102P01
XV204	Tube socket, 7 pin miniature, TS102P01
XV205	Tube socket, 9 pin miniature, TS103P01
XV301 through XV305	Socket, electron tube, 7 pin miniature, Elco BR-151-BC

SECTION VI
SCHEMATIC DIAGRAMS

This section contains the schematic diagrams for the Model 2301 Special Purpose Receiver.

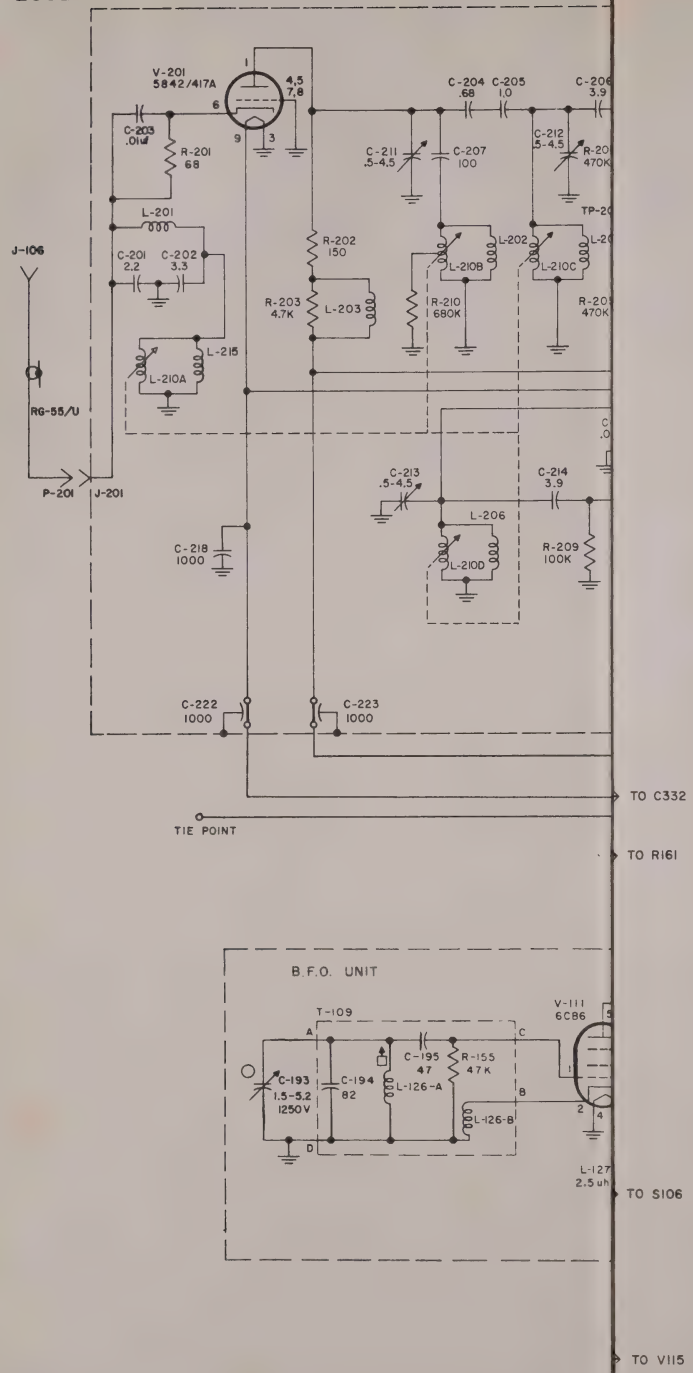
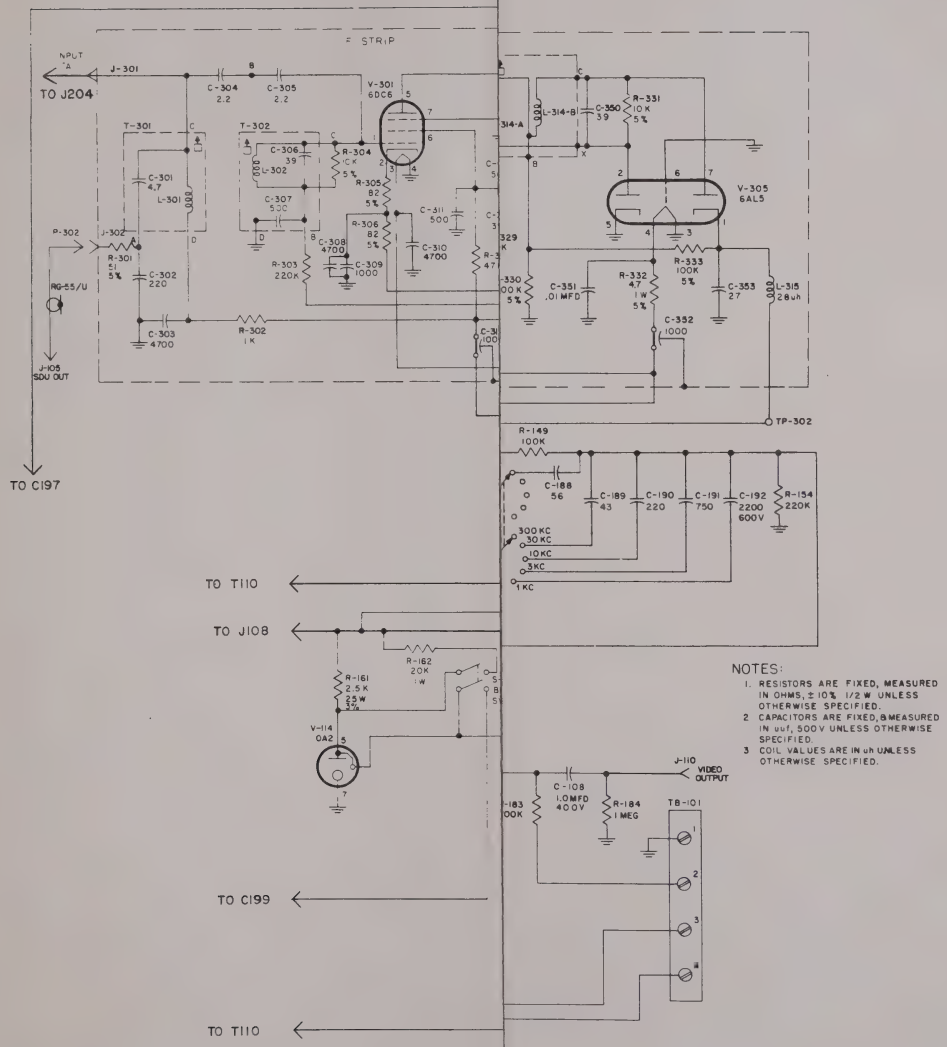


Figure 6-1. Model 2301 Receiver, Schematic Diagram (Sheet 1 of 2)



ure 6-1. Model 2301 Receiver, Schematic Diagram (Sheet 2 of 2)

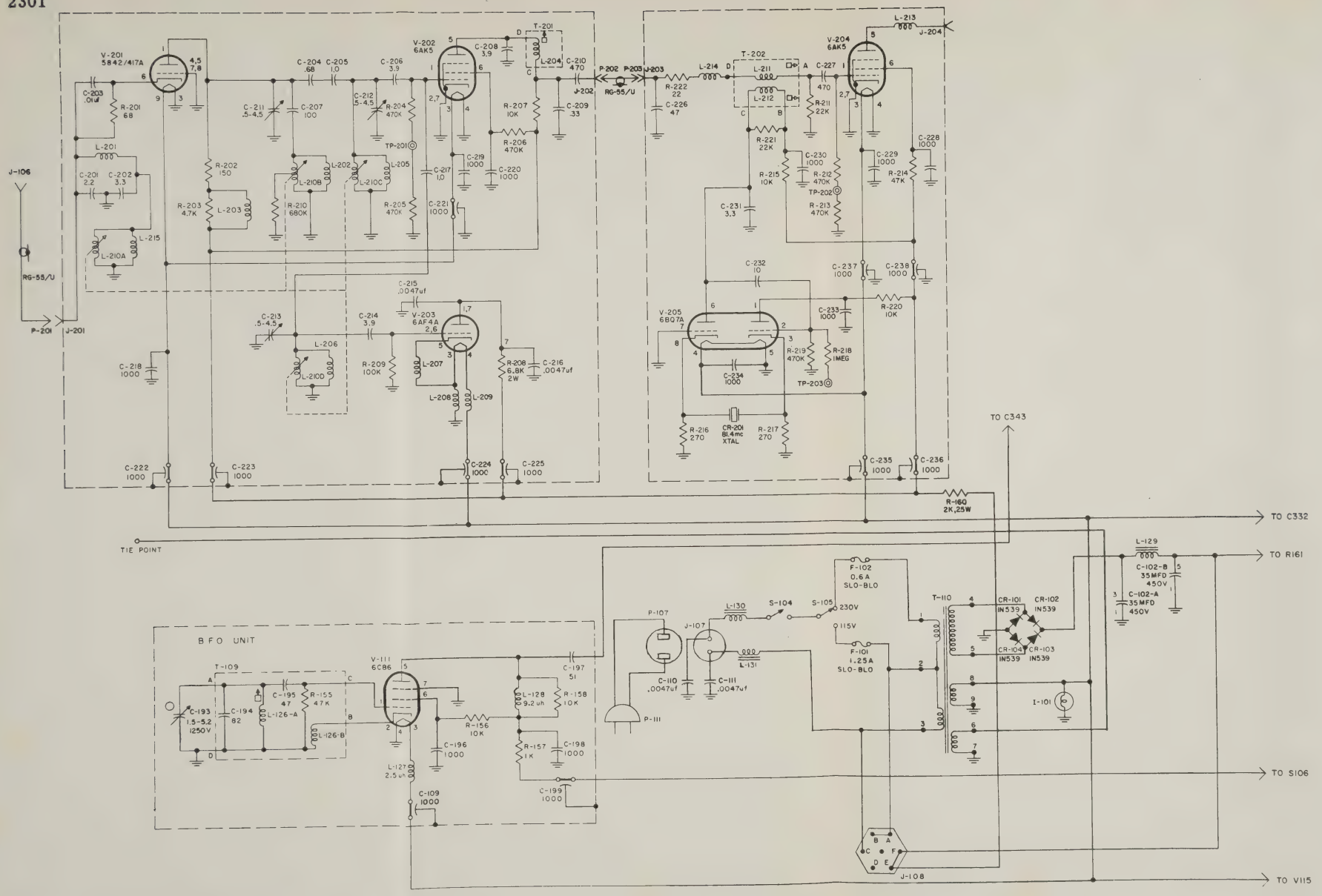


Figure 6-1. Model 2301 Receiver, Schematic Diagram (Sheet 1 of 2)

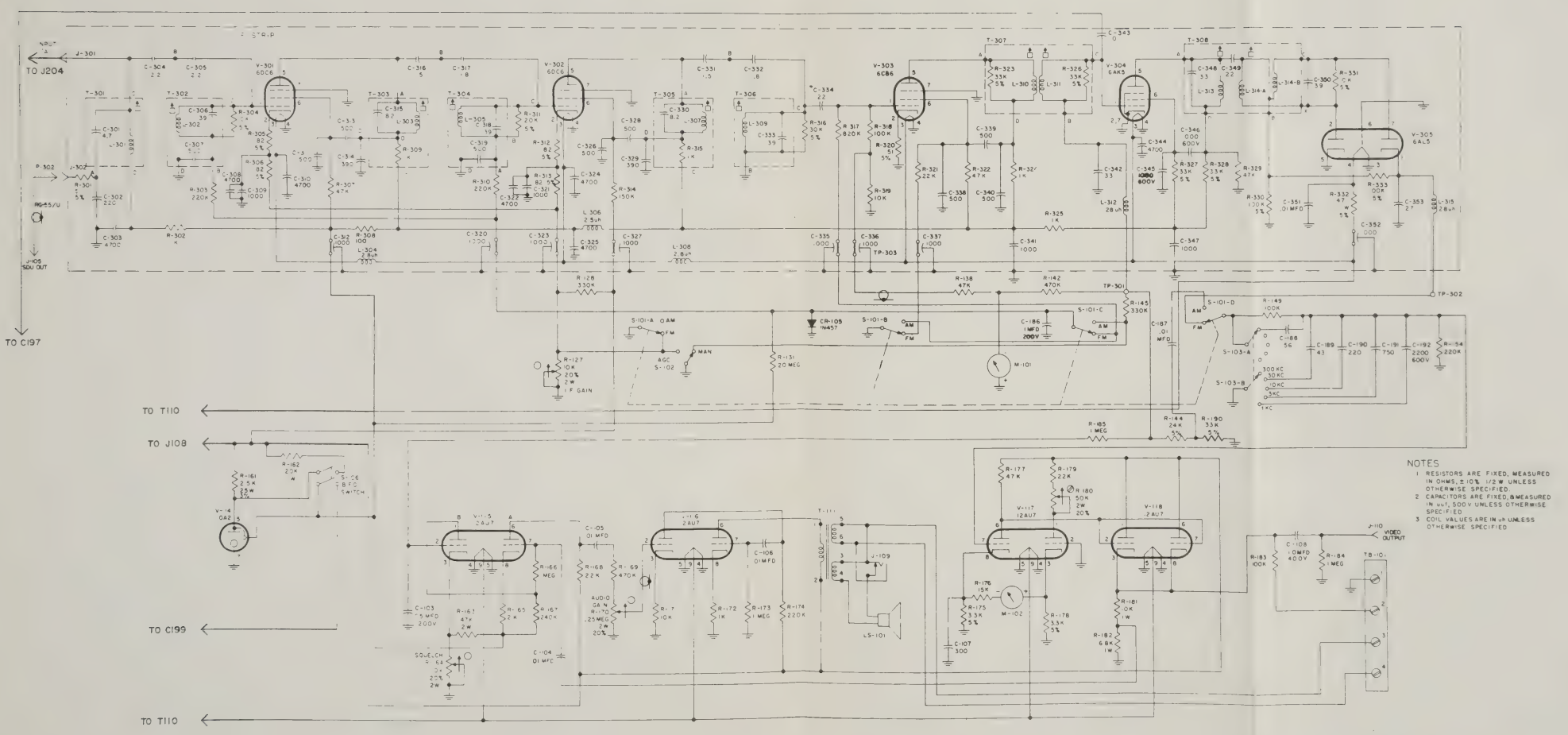
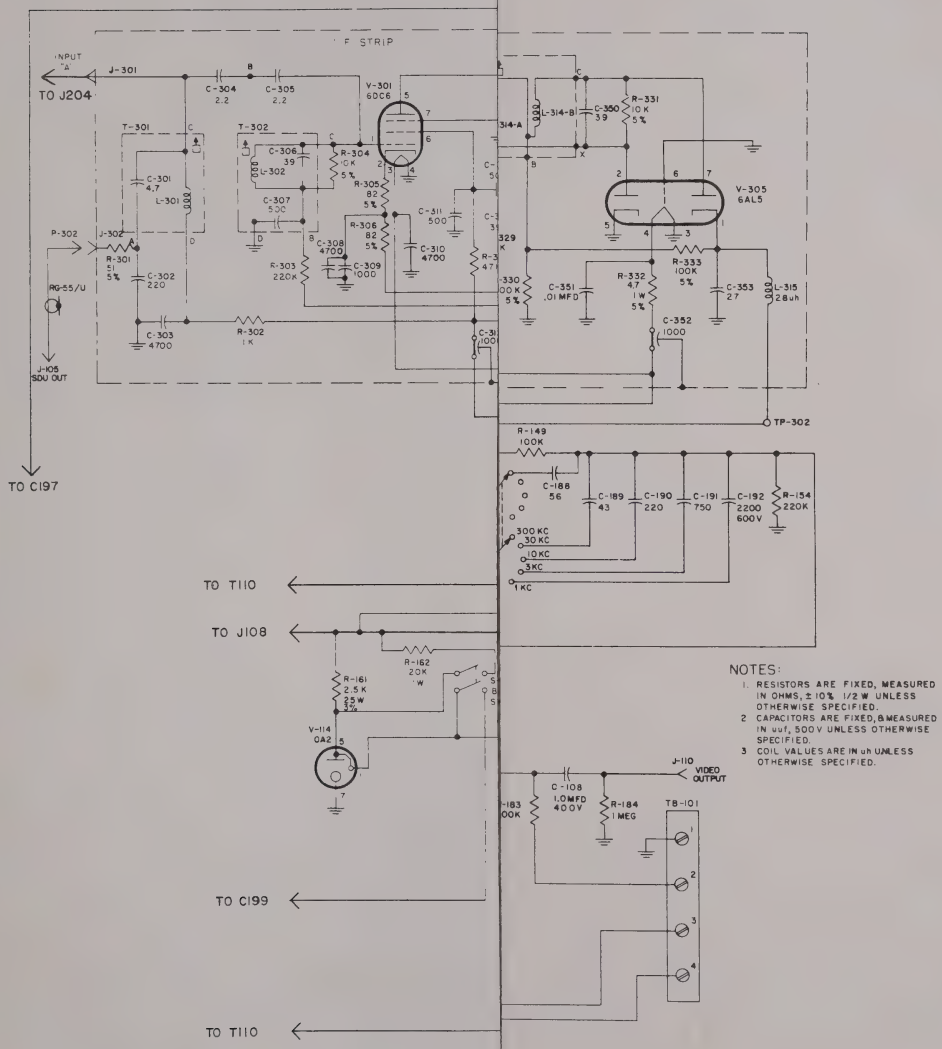

TO J204
TO C197
TO T110
TO J108
TO C199
TO T110
NOTES
1 RESISTORS ARE FIXED, MEASURED IN OHMS, ±10% 1/2 W UNLESS OTHERWISE SPECIFIED.
2 CAPACITORS ARE FIXED, & MEASURED IN μμf, 500 V UNLESS OTHERWISE SPECIFIED.
3 COIL VALUES ARE IN μh UNLESS OTHERWISE SPECIFIED

Figure 6-1. Model 2301 Receiver, Schematic Diagram (Sheet 2 of 2)



ure 6-1. Model 2301 Receiver, Schematic Diagram (Sheet 2 of 2)

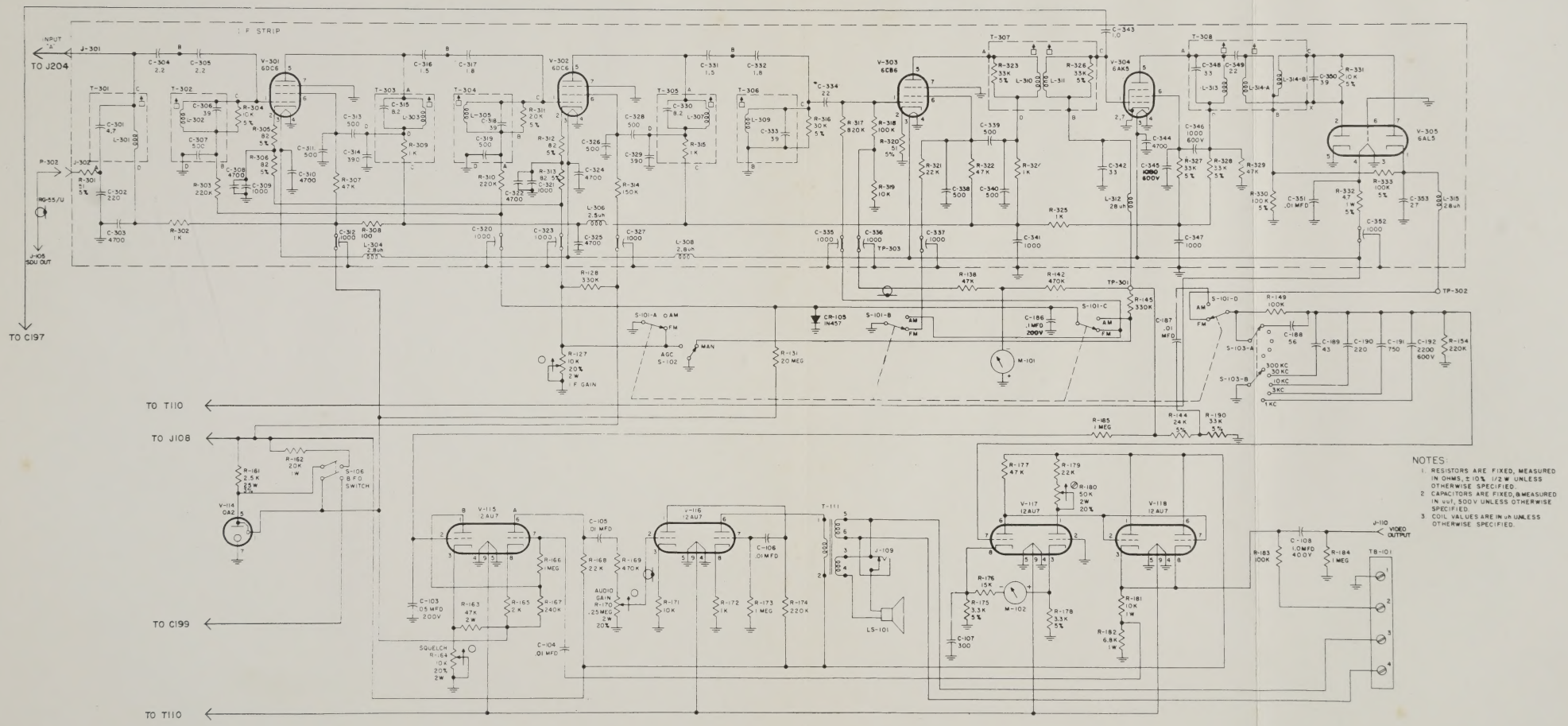


Figure 6-1. Model 2301 Receiver, Schematic Diagram (Sheet 2 of 2)

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